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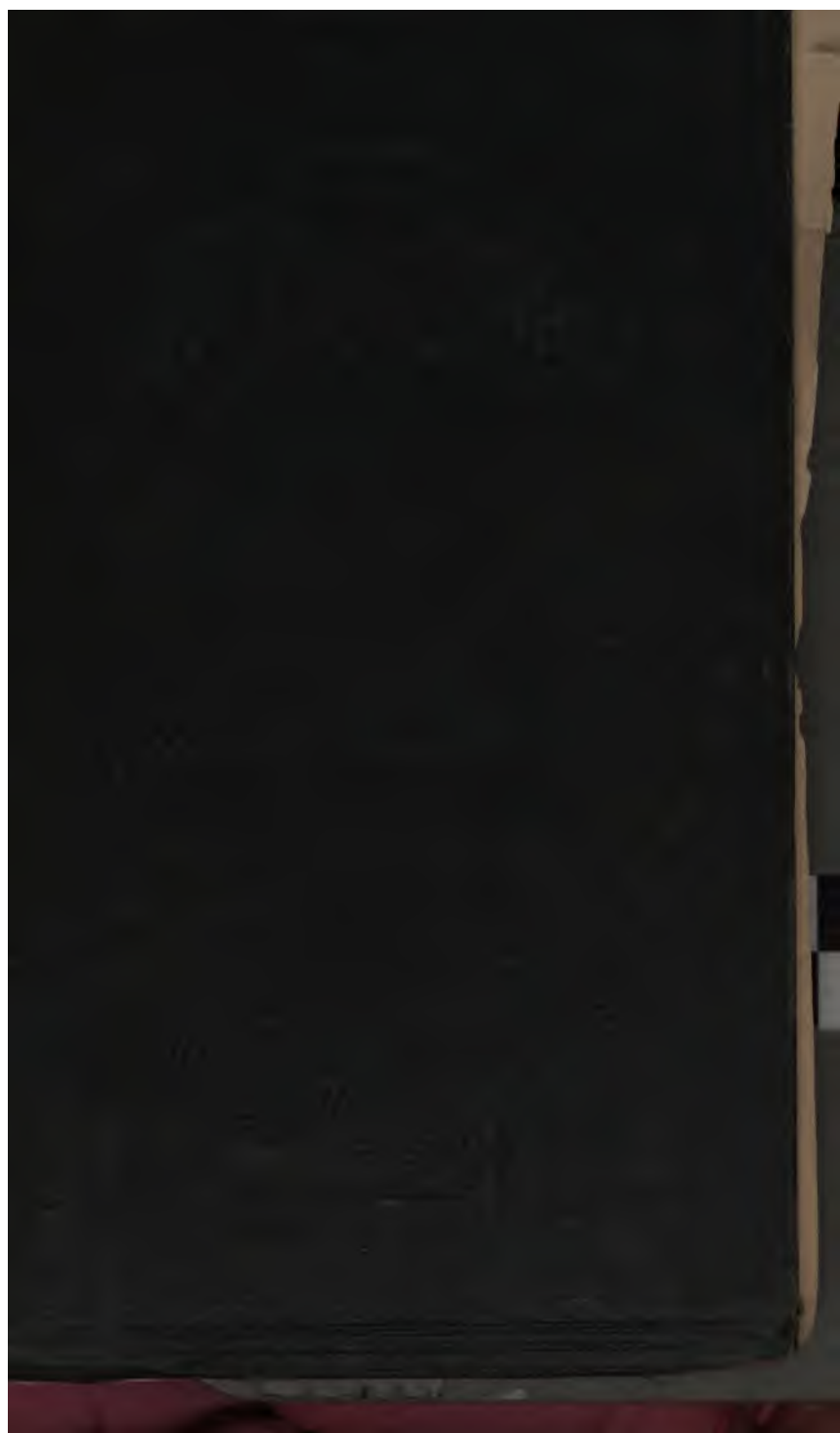
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ETHERIZATION;

WITH

SURGICAL REMARKS.

BY

Collins
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Trustees of the Massachusetts General Hospital:

These pages are inscribed by the Author, as a respectful recognition of their
interest in the introduction of Etherization into the Hospital,
and also of their benevolent and judicious labors
for enlarging the benefits of that
noble Institution.



A YEAR having elapsed since the introduction of ether into surgical practice, the period of enthusiasm has passed over, the trials of its influence have been innumerable, and the time has arrived for a dispassionate judgement of its value. These considerations might seem sufficient to have brought out the labors of some of the able and judicious persons, situated in the birth-place of etherization, who have had opportunity of experience in the ethereal practice. But, although many valuable productions on this subject have appeared, none, I believe, have brought forward the fruits of our matured observation.

The utility of a new publication has therefore been evident for some time. But this would not have been of sufficient weight to have induced me to undertake it, had not a direct application been made, and had I not been frequently called to notice the slow progress of the practice of etherization in this country beyond the vicinity of its first introduction, compared with its rapid extension on the other side of the Atlantic.



ETHERIZATION: .

WITH

SURGICAL REMARKS.

ETHERIZATION, ETC.

I.

WHAT surgeon is there, who has not felt, while witnessing the distress of long painful operations, a sinking of the heart, to which no habit could render him insensible! What surgeon has not at these times been inspired with a wish, to find some means of lessening the sufferings he was obliged to inflict!

Such feelings have often operated on my own mind, and led to various trials with many different agents, with opium in all its forms, and other narcotics, even in such quantities as really alarmed me, without any satisfactory result. Mesmerism, and its mimic, neurologism, were offered by their advocates for this purpose, but never having the slightest faith in their physical influence, their use could be admitted only as a possible means of producing insensibility to pain by acting on the mind of the patient; and although such a state of mind can be sometimes produced, yet unhappily it never was in cases under my inspection.

The discovery in these days of a property capable of so modifying the condition of the sentient organs, as

without injury to prevent the suffering produced by the division and laceration of the living textures, however desirable, was certainly unexpected. When such a property was found to exist in a well known substance, our surprise was increased, and we wondered at our own dulness in not having made the discovery before.

The general properties of ether have been known for more than a century, and the effect of its inhalation in producing exhilaration and insensibility has been understood for many years, not only by the scientific, but by young men in colleges, and schools, and in the shop of the apothecary, who have frequently employed it for these purposes.

The ethers diluted with water may be and have been administered by the mouth. They have the exciting and composing effects of inhalation, but the contact with the coats of the stomach of any large quantity of ether produces an excitement too great to justify its employment for the purpose of composing in a decided and speedy manner.

Many years have elapsed since I myself used etheral inhalation to relieve the distress attending the last stage of pulmonary inflammation. So long ago as the year 1805, it was applied for this purpose, in the case of a gentleman of distinction in the city,* very frequently since, and particularly in the year 1812, to a member of my family, who experienced from it great relief, and still lives, to give testimony to its effects. The manner

* Thomas Davis, Esq., formerly Treasurer of this Commonwealth, who died in January, 1805.

in which it was applied was by moistening a handkerchief and placing it near the face of the patient.

A new era has opened to the operating surgeon ! His visitations on the most delicate parts are performed, not only without the agonizing screams he has been accustomed to hear, but sometimes with a state of perfect insensibility, and occasionally even with the expression of pleasure on the part of the patient. Who could have imagined that drawing the knife over the delicate skin of the face might produce a sensation of unmixed delight ! that the turning and twisting of instruments in the most sensitive bladder might be accompanied by a beautiful dream ! that the contorting of ankylosed joints should co-exist with a celestial vision ! If Ambrose Paré, and Louis, and Dessault, and Cheselden, and Hunter, and Cooper, could see what our eyes daily witness, how would they long to come among us, and perform their exploits once more ! And with what fresh vigor does the living surgeon, who is ready to resign the scalpel, grasp it, and wish again to go through his career under the new auspices !

During the year which has passed since ethereal inhalation was first employed in surgical operations, an immense number of trials of its influence have been made in various parts of the world, with a success perhaps as uniform as that of any article employed in medicine or surgery, and, what is more important, with as few ill consequences. Originating in this country, and in this city, its application was immediately transferred to Europe, and hailed with delight by nearly all the eminent surgeons and physicians in England, France,

Germany, and other countries. It has been employed in all kinds of operations, in a vast number of diseases, and although its effects have often appeared alarming, no satisfactory instance of fatal consequences has as yet been demonstrated. In estimating the danger we must also take into view the fact, that since the fear of pain has diminished the number of surgical operations has remarkably increased, at least in our vicinity.

The first proposal to me for the employment of ether by inhalation, for the prevention of pain in surgical operations, was made by Dr. W. T. G. Morton, about the middle of October, 1846. Calling on me, he stated that he had possession of a means of accomplishing this object, that he had made trials of its efficacy in the extraction of teeth, and that he wished me to test its power in surgical operations. The article used for this purpose not being mentioned, I supposed it was not proper for me to demand what it was, but I did think it necessary, before taking the responsibility of using it, or sanctioning its use, to ascertain whether a trial could be made without any apprehension of danger. Having satisfied myself on this point by various questions, I agreed to give Dr. M. the desired opportunity, as soon as it should be in my power. No such opportunity having occurred within a day or two in private practice, and being at that time in the performance of my tour of duty as attending surgeon at the Massachusetts General Hospital, I seized the occasion of the first operation in that institution for the proposed experiment.

The patient was a young man, about twenty years old, having a tumour on the left side of the neck, lying par-

allel to, and just below the left portion of the lower jaw. This tumour, which had probably existed from his birth, seemed to be composed of tortuous, indurated veins, extending from the surface quite deeply under the tongue. My plan was to expose these veins by dissection sufficiently to enable me to pass a ligature around them.

The patient was arranged for the operation in a sitting posture, and every thing made ready ; but Dr. Morton did not appear, until the lapse of nearly half an hour. I was about to proceed, when he entered hastily, excused the delay, which had been occasioned by his modifying the apparatus for the administration. The patient was then made to inhale a fluid from a tube connected with a glass globe. After four or five minutes he appeared to be asleep, and was thought by Dr. Morton to be in a condition for the operation. I made an incision between two and three inches long, in the direction of the tumour, and to my great surprise without any starting, crying out, or other indication of pain. The fascia was then divided, the patient still appearing wholly insensible. Then followed the insulation of the veins, during which he began to move his limbs, cry out, and utter extraordinary expressions. These phenomena led to a doubt of the success of the application, and in truth I was not satisfied myself, until I had, soon after the operation, and on various other occasions, asked the question, whether he suffered pain. To this he always replied in the negative ; adding, however, that he knew of the operation, and comparing the stroke of the knife to that of a blunt instrument passed roughly across his

neck. Now that the effects of inhalation are better understood, this is placed in the class of cases of imperfect etherization.

On the following day, an operation for the extirpation of a tumour from the arm was performed by Dr. Hayward, during which the patient exhibited no sign of physical or intellectual suffering.

A few days after these first operations I was informed by Dr. C. T. Jackson, a gentleman well known for his chemical and philosophical attainments, in a conversation which took place between him, Dr. Augustus Gould, (the naturalist,) and myself,—that he first communicated to Dr. Morton the inspiration of ether, as a means of preventing the pain of operations on the teeth. This I have already stated in the account of the first six cases of ethereal inhalation, written at the request of a gentleman who took great interest in the introduction of ether, R. H. Eddy, Esq., and published in the Boston Medical and Surgical Journal of December 19, 1846.

Anxious to extend the benefits of the inhalation to as many patients as possible, believing a peculiar apparatus necessary, and having the use of none excepting that in the hands of Dr. Morton, I requested Dr. Charles Heywood, the house-surgeon of the Hospital, who took an early and active interest in this matter, to procure a glass globe, and add to it the tube necessary for its application. At this period, however, I was checked by the information, that an exclusive patent had been taken out, and that no application could be made without the permission of the proprietor. The knowledge

of this patent decided me not to use, nor encourage the use of the inhalation, until a more liberal arrangement could be made. Dr. Hayward concurred with me, and having procured from Dr. Morton a letter of explanation to the surgeons of the Hospital, which was judged satisfactory, we felt ourselves justified in prosecuting the practice without restriction.

From this time the use of ether was adopted in the operations at the Hospital by the various surgeons of the institution, Drs. Hayward, Townsend, J. Mason Warren, Parkman, and H. J. Bigelow, as well as by myself, with uniform success, so far as its great object, the existence, or at least the recollection of pain was concerned, but with symptoms varying in degree from total insensibility to a knowledge of surrounding objects and passing events. I may also add with pleasure, that the physicians of the Hospital, Drs. Bigelow, Hale, J. B. S. Jackson, Bowditch, Holmes, and Fisher, gave their early attention to the subject, and uniformly and unanimously concurred in opinion with the surgical department. Among other physicians of this place, who took an early and decided interest in this subject, I shall only mention Dr. James Jackson, late Professor of the Theory and Practice of Medicine, and Dr. A. L. Peirson, of Salem. In private practice successful applications were immediately made in the presence of physicians, surgeons, and others, affording them the same satisfaction which we had experienced.

Accounts of these wonderful performances were at once transmitted to Europe, by Drs. Ware, C. T. Jackson, H. J. Bigelow, Morton and myself.

From that period to the present I have operated, and assisted in operations where ether was employed, in about two hundred cases, and have directed its use in a number of patients under my care where I was not present. To the information obtained from these operations I have the advantage of adding a large number performed by my son, Dr. J. Mason Warren, the details of which were furnished me as they occurred.

II.

The appearances presented by the patients under the influence of ether have a general resemblance : they are varied, however, by the constitution of the patient and the mode of application, so as to present exceptions, to an extent it would be useless to describe.

The first inhalations were made through the tube and glass globe of Dr. Morton, afterwards a sponge, as applied by Dr. Mason Warren in the cases of children, was used also in those of adults, found to be more safe and convenient than the tube, and therefore employed in the greater part of our practice.*

The first symptom usually noticed is a short cough, which impels the patient to remove the sponge ; but being urged to allow it to be replaced, he readily consents, perhaps after a slight expectoration, and no severe pulmonary irritation being felt, he proceeds to inspire the va-

* Dr. Mason Warren first used the sponge for children in February, 1847—[see Boston Medical and Surgical Journal for March.] At about the same time it was used by Dr. Smith, a distinguished physician of Cheltenham, England, but does not seem to have been extensively employed by him till the latter part of March, or first of April.

porous draught more and more deeply, until he becomes insensible. The respiration is then often audible, and sometimes even apoplectic; afterwards feeble and almost imperceptible—a state, which, however accustomed to it, excites a degree of uneasiness on the part of the surgeon, and leads him to investigate more carefully the condition of the pulse. My own practice has been, when not doing the operation myself, to keep the fingers applied to the patient's pulse during the whole process of etherization. This, quickened from mental causes before the operation, is still more so a short time after inhalation, sometimes excessively; subsequently it becomes slower, feebler, and even scarcely perceptible. When this is found to be the fact, the sponge being removed, the pulse becomes more free; then, if necessary, being re-applied, the same phenomena may present themselves many times during a long operation. The pulsations of the heart are often hard and vibratory. The circulation in the capillaries, especially of the face, neck and upper part of the chest, is so much increased as to redden the skin, an appearance which rarely continues long, and gives place to paleness, succeeded by cold perspirations.

The gastric phenomena are less remarkable. There is a propensity to nausea in a number of cases, which not unfrequently amounts to vomiting, sometimes protracted to the following day. Relaxation of the vesical or intestinal sphincters does not ordinarily occur, but it is certain that in strictures an instrument may be more readily passed through the œsophageal and urethral canals in a state of etherization.

In a female patient affected for many days with an

absolute retention of urine, etherization was followed by a free excretion, and the retention never returned. Whether in this case the relief was obtained by relaxation of the vesical sphincter, or by tonic etherization of the vesical parietes, it really is not possible to say.

The muscular apparatus is excited at an early period. The fists may be clenched, the muscles of the upper extremities and neck contracted, sometimes cataleptically; more commonly they perform various movements, as if the patient were trying to extricate himself from his new situation. Such movements are less frequently seen in the lower extremities.

The conjunctiva of the eye is often injected with blood; the pupils generally contracted, sometimes dilated in a powerful etherization, frequently fixed. The eyelids are occasionally strained open, more frequently closed; and when closed, the patient, if still conscious, being called on to open them, has the power of doing so, thus affording a test, which, though by no means universal, in some degree enables the operator to determine whether the operation shall begin.

The most curious of the changes produced by etherization are those of the sensitive and intellectual functions; these changes, however, are exceedingly various in their form and order, but they usually terminate in a suspension of both sense and intelligence. In a number of instances tactile sensation, the sense of feeling, appears to be suspended, (as the patient has no recollection of suffering,) while the intellect exists. The organ of intellect seems capable of taking cognizance of objects external, while it either does not

notice the impressions on the feeling nerves, or if it does they do not produce on it the usual effects.

These appearances, at first so astounding and unintelligible, seem to support the doctrine so satisfactorily explained by Dr. Carpenter, in the British and Foreign Review, No. XLIV, and in return are illustrated and explained by this doctrine, viz. that the seat of tactile sensibility is in the great cephalic ganglia, while the intellectual functions reside in the cerebral lobes. If these lobes were, as formerly believed, the *sensorium commune*, or common centre of all impressions, as well as of intellectual functions, then it would be difficult to understand how common feeling, or tactile sensitiveness could be suspended, while intellect, and even visual and auditory sensibility continued. But if tactile sensitiveness reside in the thalami, corpora striata, or annular protuberance, it is possible it may be suspended without suspension of the action of the cerebral lobes. So visual sensation, residing in the tubercula quadrigemina, may be, as we know it often is, intermitted without intermission of intellect; and the same may be said of the auditory function.* Hence arises a question not so satisfactorily answered, — why in some cases etherization should affect the seat of common feeling, i.e. the ganglia, without in the same degree affecting the cerebral mass? for these ganglia are not so situated, as to come under the ethereal influence through the circulation earlier than other parts of the encephalon. And if we admit that the influence is introduced through the

* Vide Appendix B.

nerves, then the par vagum, or pneumogastric nerves originating from the medulla oblongata would, we should expect, influence this part primarily, which thus being obnoxious to the first attacks of ether would experience an interruption of its function, and reacting on the lungs produce a suspension of respiration. This, we know, does sometimes happen, but generally in an advanced stage of etherization, and after the interruption of functions depending on other parts of the encephalic mass.

Flourens, Longet, and other French physiologists, as appears by reports and discussions before the Royal Academy of Medicine in Paris, in March and April of the present year, and which are reported in the Paris Medical Gazette of Dr. J. Guérin,* have been able by experiments on animals to satisfy themselves what parts of the brain are first etherized, and in what order the others follow. The course of my experience in human etherization is in favor of the opinion expressed by Professors Roux and Velpeau, that the symptoms are not so distinct, nor so regular, as to enable us to determine with precision which division of the nervous system will be first affected, and in what order the others.

To illustrate the fact, that tactile sensation may be suspended without suspension of intellect, two or three cases may be mentioned, which are, of course, to be considered as not exhibiting the most perfect phenomena. In the month of April, 1847, a medical gentleman

* This journal was one of the earliest and most judicious supporters of the claims of etherization to public attention.

brought his wife to Boston from a great distance, for the removal of a scirrhus tumour under the influence of ether. The apprehension of pain had led her to object to the operation, until she became acquainted with the power of ether. She was thirty-five years of age, a lady of education, and what is usually called a nervous person. Being placed in the upright posture inhalation was applied by the sponge. At first it caused some pulmonary irritation; she was soon after able to inhale freely, and showed marks of physical and mental excitement. She talked wildly, cried, and sank down in her chair: she thought she was in the cars, and complained of the motion. The sponge was employed for fifteen minutes without signs of loss of intellect. Apprehensive of the effect of too long a use of ether, I determined to begin the operation.

To the incisions in the skin she exhibited no marks of sensitiveness, soon after cried out, and made considerable movements, which continued through the operation. Her husband, an intelligent physician, pained and disappointed by her apparent suffering, considered etherization to be a failure. After all was concluded she expressed delight, that she had been relieved of her disease without pain; and during the cure repeatedly made use of the same expressions, exhibiting an unusual cheerfulness caused by her escape from suffering.

This lady could see, hear, answer questions, and understand the directions and persuasions addressed to her; yet she uniformly said, that the operation had given her no pain. It has been suggested, that in such cases the pain is not recollected; but the supposition that

one intellectual, i. e. cerebral, faculty is suspended, while the others continue, is more difficult than that of the suspension of the feeling-faculty independently of the intellectual.

Soon after the above operation, a gentleman who resided at a great distance, came to Boston for the purpose of having a tumour removed. He informed me, that although usually in the enjoyment of good health, he was of a nervous temperament, and readily agitated by moral and physical impressions. Preparatory to the operation he was placed on a bed. The head being raised, a sponge was applied to the nostrils, and the mouth closed; as it has appeared, that less cough is produced when the inhalation is through the nostrils. For five minutes he showed no external sign of etherization; then said, "now it is beginning,"—"I feel it in the chest,"—"now I feel it in the legs." Presently he began to speak rapidly, rose from the bed, and with many gesticulations uttered a harangue, partly on politics, partly on the medical profession, to which he was highly complimentary, but principally on the blessings which would flow to humanity from the discovery of etherization. This state was so gratifying, that with difficulty was he prevailed on to resume his place on the bed, and to reapply the sponge. In a few minutes more he closed his eyes, and believing him asleep, the operation was begun. He immediately spoke, encouraged its prosecution, and in two or three minutes it was concluded. Thereupon he again broke forth in a highly poetical strain, described the delight he had experienced from the passage of the knife through the skin, the

gratification he felt at the different steps of the operation, and its happy conclusion.

The symptoms of etherization continuing, I remained with him half an hour, during which he exhibited a variety of emotions, mostly of a pleasurable character, but terminating in a hysterical affection with a free discharge of tears. From time to time muscular tremors pervaded his whole system, especially the lower extremities, without movements of the limbs. His wound, two or three inches in length, was perfectly united on the third day, and on the fourth he left Boston.

In the latter part of May, 1847, another instance occurred, in which the intellectual faculties were awake through the whole operation, together with movements so strongly indicative of pain, that two very intelligent physicians present were satisfied the ether had been of no use, till after the operation, and at subsequent periods, they had an opportunity of questioning the patient themselves, with the uniform reply, that she had experienced no suffering. The disease was a tumour in the right breast, which, although it was only of five weeks' continuance, had attained the size of a lemon, and was rapidly increasing. It proved to be a dark-colored, vascular growth, of soft consistence, having the appearance of malignity, with the exception that its circumference was quite regular and separated from the glandular texture in which it was buried, by a distinct, though very thin sac.

This lady was forty-five years old, married, quite fleshy, but not remarkably healthy, and very excitable, or nervous, of course dreading the operation, and glad

to resort to the use of ether. The horizontal posture was employed, and the sponge applied to the nostrils ; in a few minutes her limbs became agitated, she talked a great deal, and displaced the sponge. More than a quarter of an hour elapsed before she became sufficiently tranquil to begin the operation ; and it would have been delayed longer, for the purpose of increasing the etherization, but that some apprehensions existed of its consequences in such a constitution. Similar apprehensions have frequently had a similar influence, until a more prolonged experience proved them to be groundless. The first incisions of the knife, pretty extensive, caused no movement. As the dissection proceeded, there occurred motions of the body and limbs, wild cries, protestations on the part of the patient of her great resolution and ability to endure suffering, frequent appeals to her physician to bear testimony to the fortitude with which she had supported various diseases, and strange dreamy expressions of apprehension from an operation she was expecting to undergo. With difficulty the morbid mass was extirpated from its connection with the mammary texture, and the operation was undoubtedly more protracted than it usually is in patients not etherized. There was much bleeding, and a number of arteries were tied.

The principal symptoms of etherization disappeared in about half an hour. The following day she was tranquil and comfortable, with the exception of vomiting, which had continued from the time of the operation, and declared she had not suffered but from the ligature of the arteries. The unmanageable state of this patient

during etherization caused at the time a sentiment of regret at its use ; but subsequently, when she expressed her great satisfaction at having escaped the dreaded pain, the ultimate conclusion was in favor of ether.

To these cases many similar might be added, but I will only mention one, which did not occur in my own practice. A friend of mine, a lady, had three teeth extracted under etherization. She was perfectly able to count them as they were removed, but was entirely without pain during the extraction of the first two. Of course the seat of intellect was not etherized, while that of pain was, during these two operations.

The phenomena of these cases support the opinion, that the seat of intellect and that of pain are different.

The intellectual phenomena, while the cerebral functions are in a state of activity, though exceedingly various, are principally of two kinds, — the gay, and the lachrymose. The former, most frequent in males ; the latter in females ; in both the most prominent trait of character is apt to be displayed and exaggerated. In general, it may be said, that in most cases of etherization, there is a gradual increase of the cerebral excitement, till somnolence suddenly appears ; and on the return of intellect, this state, at first strongly marked, gradually fades into the ordinary condition of the mental faculties ; but to this course there are many exceptions.

The young man, whether in a state of somnolence, or of excitement, has visions of rioting, travel, happy meetings with distant friends, and many enjoy the idea of the rapid motion of the rail-cars. A sea-captain made a voyage to Sumatra, and triumphantly repulsed a host

of Malays, who were assailing him with pikes and cutlasses. Combativeness, attended with oaths and imprecations, is sometimes developed in a degree troublesome and even alarming to those around. This disposition is frequently alternated with strong expressions of affection and gratitude.

The female exhibits hysterical phenomena. She has alternate fits of laughing and crying, though more disposed to the latter than the former ; and if married, she has dreams of her distant husband, or absent children. A female, who had exhibited restlessness during an operation, said, she dreamed that her child affected with hooping cough, and having a paroxysm of strangling, seemed neglected by her husband, who was unwilling to raise and support it. Indelicacy in expression or action has never presented itself in the range of my experience.

The manifestations of passion are so numerous that it would be difficult to describe them all, but those enumerated will perhaps be sufficient to convey a notion of their character. Pleasurable sensations seem on the whole to predominate ; and many patients, both male and female, are anxious to renew the gratification they have experienced.

III.

A question has arisen as to the channel through which ether passes into the system from the pulmonary organ; and specifically, whether it produces its effects through the medium of the nerves, or that of the blood vessels. In favor of the former opinion, is the rapidity with which it operates; and its analogy, in this particular, with the action of some poisons, supposed to exert their influence through the nervous system, as for example that of prussic acid applied to the mucous membrane of the tongue. If this influence is transmitted by the pulmonary nerves, the medulla oblongata through the par vagum would necessarily receive the first shock, as already suggested; its functions would be suspended, and life irrevocably extinguished. Should it be objected, that the medulla could not be so powerfully affected by a retrograde nervous action through the pneumogastric nerves, the hypothesis falls to the ground. The other pulmonary nerves can hardly be supposed to form a channel of communication to the exclusion of the pneumogastric. The opinion may

perhaps be tested by experiment, yet it must be confessed it is hard to conceive that any such experiment should be quite satisfactory.

The rapid introduction of ether through the vascular network spread in the pulmonary mucous membrane, is not difficult to understand. The immense surface formed by the pneumonic vesicles, the infinite number of capillaries spread through their parietes, the facility with which air and other fluids are imbibed by them, and the rapidity with which the blood, charged with these fluids, courses through the system, seem to afford a satisfactory answer to the proposed question. The principal difficulty appears to be in the last of these facts—the rapidity of the etherization compared with that of the circulation. We have rarely seen any important signs of etherization in a period short of two minutes. Now it is perfectly established by experiments mentioned by Muller, as having been performed by Mayer, (vide Muller's Physiology, vol. i. p. 239,) that on the introduction of a solution of the prussiate of potash into the lungs, the presence of this salt could be detected in the serum of the blood by the blue precipitate produced by the addition of the sulphate of iron, as early as from two to five minutes.

But laying aside this and all other experiments on animals, we are able to show the rapid course of the blood, by observations on the living human body many times repeated. In persons affected with chronic inflammation of the prostate gland and of the mucous coat of the urinary bladder connected with it, for example, the introduction of a glass of wine into an

empty stomach will, in particular subjects, and especially in those not accustomed to the use of wine, cause a painful irritation of these organs in less than three minutes. An observation of this fact in different persons, and of its frequent occurrence in the same person, allows no doubt as to its exactness.

The internal pulmonary is vastly greater than the internal gastric surface; the tenuity of the mucous membrane of the former, greater than that of the latter; and the disposition to imbibition much exceeding in the pulmonary that in the gastric surface. As ether received into the pulmonary blood, and sent to the left cavities of the heart, must be transmitted in a few seconds to the encephalic masses, there seems to be no difficulty in believing, that in two minutes a sufficient quantity might be received to produce its peculiar effects. On the whole then, the opinion, that etherization takes place through the blood vessels, is the most satisfactory.





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IV.

No powerful medicinal substance is without its mischiefs. Opium, antimony, quicksilver, and other violent medicines, occasionally produce alarming and even fatal effects. That so active and volatile a fluid as ether, employed to produce a temporary abolition of the faculties of feeling and of intellect, should occasionally bring on dangerous symptoms, might naturally be expected. Perhaps the apprehensions arising from this cause have formerly checked the thought of employing it in the way of inhalation. And hence, no doubt, when etherization was first introduced, judicious persons were of opinion so many alarming symptoms would follow its introduction into the pulmonary organs, that they were led to prognosticate a short reign to ethereal practice ; and we must confess, that a case of perfect etherization can rarely be witnessed, without a sentiment of uneasiness, and an anxiety to see the patient recover from his partial and temporary death.

The most remarkable ill effects we have noticed are of two kinds ; first, those caused by the exclusion of the

oxygenous principle from the lungs; and second, those from excessive etherization of the nervous centres.

✓ 1st. The ill effects arising from the exclusion of oxygen occurred in the early part of the ethereal practice. Their occurrence led me to believe and to say to the medical class, that the interruption of the sensitive and intellectual faculties arose from asphyxia,—an opinion which has also been advanced and ably supported by one of the most distinguished physiologists of the present time, M. Flourens, and by others. The appearances which led to this opinion were, an increased labor, and sometimes even a suspension of respiration, a dark color of the skin, a purple flow of blood from divided arteries, an increased fluidity of the blood, a difficulty in suspending hæmorrhage, and a disposition to its recurrence. When to these were added the loss of sense, both nervous and cerebral, and a deathlike coldness of the body, we were led to consider as present the phenomena of asphyxia, and to view them as constituting a formidable objection to the new practice.

An accident of this kind occurred in an operation performed in November, 1846, for the removal of a tumour of the lower jaw in a female about forty years old. Etherization was effected rather slowly, and of course more ether was imbibed than in most cases; but insensibility at last appeared, and the operation began without exciting any marks of pain. Soon after the patient uttered some cries, her respiration became convulsive; a violent cough with symptoms of suffocation followed; the skin became livid and cold, the arterial

blood dark colored, the respiration and pulse imperceptible; and of course a strong apprehension was excited, that life might be extinct. Under the use of stimulants, frictions, and change of posture, the vital actions reappeared, and the operation was satisfactorily finished. The hæmorrhage was great, many arteries requiring ligature. In the course of that day, and even the following, there were fresh bleedings. Ultimately, the patient did well.

About the same time, very similar appearances presented themselves in a case of excision of a portion of the upper jaw.

Such instances as these occurred, however, only in the early history of etherization, when the valved tube was employed to limit the entrance of atmospheric air, and produce a more exclusive inhalation of ether. As soon as the valve was removed, and especially after the introduction of the sponge, asphyxia ceased to occur, so that, in upwards of a hundred consecutive cases, there has not been more than a single instance, and this of short duration. There are no longer to be seen those violent struggles for breath, purple hue of the blood, or difficulty in the suppression of hæmorrhage. Of course we can no longer entertain the doctrine, that the state of etherization is a state of asphyxia. In the opinion of some, asphyxia is occasionally brought on, not by the substitution of ether for air in the lungs, but by the exclusion of the latter, in consequence of closure of the glottis from spasm of the laryngeal muscles.

According to another doctrine, which has been advanced, and which seems to be a modification of that

of asphyxia, etherization produces its peculiar effect by a combination of asphyxia and intoxication. Ether, we know, at a high temperature having a strong affinity for oxygen, combines even with that of the atmosphere at the temperature of the lungs. According to the present theory, a part of the ether inhaled is capable of being decomposed by the pulmonary temperature ; and being decomposed, or in other words burnt, combines with the oxygen which should unite with the blood, and thus prevents its due oxygenation. The consequence will be, the circulation of a semi-oxygenated blood, an imperfect hæmatisis, and a partial asphyxia. Another portion of ether is imbibed by the blood, and acting as a toxic principle, paralyzes the nervous system. However true the last part of this theory may be, the former will find a practical objection in the fact frequently noticed in these remarks, that the phenomena of asphyxia are absent, when etherization is accomplished by the sponge, or by any apparatus in which a sufficient quantity of atmospheric air is inhaled with the ether.

There is a strong resemblance between etherization and alcoholization. Without entering into the discussion of a question, which for the want of a sufficient number of facts cannot be satisfactorily answered, we will simply say, the effects of alcohol are more gradual in their production, more slow in their disappearance, operate more decidedly on the cerebrum, and less on the sensitive faculties.

2d. The principal known ill effect produced by excessive etherization of the nervous centres, is a state of

general convulsions, without signs of asphyxia. This is sometimes so violent, as apparently to threaten life ; but by immediate suspension of the ether, and the free affusion of cold water, the convulsions cease, and do not recur. A young medical gentleman underwent an operation for a contraction of the hand, extended to about fifteen minutes. On the first inhalation, he had very agreeable visions, imagining he saw the twelve apostles, one of whom assured him, that the success of this operation would serve as an evidence of the truth of Christianity. This agreeable dream was interrupted by the strokes of the scalpel ; intelligence was restored ; he became very restless ; demanded more ether, and this being administered, insensibility returned, followed by a convulsion threatening the extinction of vitality. But on the free application of cold water, the frightful agitations ceased, and permitted a satisfactory conclusion of the incisions.

In a case of operation for the removal of diseased bone, at the Massachusetts General Hospital, at which were present among others two distinguished surgeons of New York, Drs. Stevens and Parker, the patient not being very susceptible to the action of ether, the application was continued from ten to fifteen minutes, and his stomach being well charged with food, he had first a violent vomiting, and soon after a general convulsion. This lasted a very short time, did not recur, nor was it followed by any ill consequence. Perhaps, in this case, the patient was overdosed ; and it might have been better in this, and may be in other similar cases, when the patient is unusually insensible to the

ethereal action, not to prolong the inhalation to a great extent. After all, the occurrence of convulsions is so very rare, that it must be considered an exception to a general fact, and to form no greater objection to etherization than the occasional overaction of many other articles of the *Materia Medica*.

On the same day, in the presence of the same gentlemen, an operation was performed for the removal of a fibrous tumour near the knee joint, under a perfect etherization, without suffering, and without unpleasant symptoms.

There are a few cases, in which ether renders the patient unmanageable; and although most of them may be successfully treated by prolonged etherization, yet, when the proposed operation is not very painful, it seems best to relinquish the inhalation. In October, 1847, a patient was to be operated on for the radical cure of an inguinal hernia. We did not wish to use ether, because the pain of the operation would be very slight; but as he strongly demanded it, the sponge was applied for ten minutes, without any satisfactory effect. The inhalation being still continued, he became uneasy, and finally so ungovernable, that the operation was postponed.

Other less important unfavorable symptoms might here be mentioned; but as these vary excessively, and are stated in the different cases, it will be unnecessary to recur to them in this place. No instance of death in man from inhaling ether has occurred in our knowledge, or belief. For although there have been a number of cases reported as fatal, yet in these the

connection between the cause and its supposed effect appears to be too imperfect to bear a close examination. Only one occurrence of this nature has happened here. A boy of very bad habits, whose arm was torn off by machinery, had an amputation at the shoulder-joint skillfully performed by Dr. Lewis on the day after the accident under etherization, and died in eight hours.

Is there any thing remarkable in the death of a boy, in the habit of using spirituous liquors freely, from a laceration of the arm near the shoulder, requiring an amputation at the joint? How many surgeons have had the pain of witnessing the failure of a patient from the shock of a severe surgical operation! Is it not wonderful, that among the hundreds of surgical operations performed in this city under etherization, only one has had a fatal termination? How many thousand have been executed in Europe within the ethereal period, and how few of the subsequent deaths have been imputed to this cause! A number of these imputed cases, so far as we have heard of them, may fairly be attributed to that terrible shock of the nervous system produced by a great surgical operation; a principal part of which shock is in many cases the effect of the pain, which the virtue of ether prevents; and the others to different causes independent of ether. Those who have serious doubts as to these cases, will find their apprehensions relieved by the distinguished Mr. Travers's work on Constitutional Irritation, and the able article on Etherization in the *British and Foreign Medical Review* for April, 1847.



be made against the use of a number of the most valuable remedies of the *Materia Medica*.

A more plausible objection is, that ether may be used too frequently ; that it may be employed to produce a state of intoxication ; that it may be and has been administered to infants for very slight causes. The same objection may be made to opium, hyosciamus, the other narcotics, and to many other medicines. Ether has one advantage over many of these, that it cannot be introduced secretly, as its volatility diffuses it so widely that its presence is immediately detected. In regard to intoxication, it must be admitted, that it may be and has been employed for this purpose ; but so far as is known, it has rarely been habitually used, and is not likely to be, because there is no adequate pleasure at the moment of its reception, and because the exhilaration is too brief and too violent to become an object of strong and general desire.

Another imputation against the practice, is its tendency to the production of chronic pulmonary affection. So vast is the number of instances, in which no pulmonary disease has followed, that it can hardly be necessary to combat the terrors of such an opinion ; for, even if disturbance in the pulmonary organ did sometimes occur, it ought to be considered as an extraordinary occurrence. If any of the supposed mischiefs actually arise, they would, from the nature of the application, be of an acute, rather than of a chronic character, and we should at once discover the evil, and shape our practice accordingly. Our experience has known no other derangement, either chronic or acute, than tran-

sient soreness of the chest in some delicate females, and in a single instance a cough, attributed to the ether without any sufficient reason. On the other side, it may be said, that ethereal inhalation is the most powerful of known expectorants, and that it has, under our observation, proved very efficacious in chronic bronchitis and spasmodic asthma. Nysten, more than thirty years ago, in the *Dict. des Scien. Med.* vol. xiii. 1815, recommended "the inhalation of ether, as having been employed with advantageous effects in chronic catarrh, spasmodic asthma, and other diseases, respired for one or two minutes, and repeated five or six times in the day."

In speaking of the dangerous effects of inhaling ether, we have not alluded thus far to its employment by the dentist, because in his cases its application is usually more brief, and its introduction more limited. But as there must be, as has been shown, great differences in the dispositions to be affected, and of course many instances of a necessarily prolonged application, we might reasonably expect to hear of a certain number of fatal terminations, if this is really a sufficient cause for their production. Now, we know that in the practice of Dr. Morton and other dentists in this city, cases of etherization have amounted to some thousands. Has any one among us heard of a death from etherization after the extraction of a tooth? We also must recollect the hundreds of thousands which have occurred in the great countries of Europe, and if we look into the foreign journals for the records of mortality in these cases, what will be the result?

The Council of Zurich, for reasons we are not acquainted with, have prohibited the use of ether in the extraction of teeth. Probably, when they have had more experience of its innocuity, they will be disposed to repeal the prohibition, and allow their citizens the privilege of avoiding the pain of tooth-pulling. The use of ether in the removal of the crowns of the primary teeth in children is certainly unnecessary, and therefore objectionable.

An apprehension has arisen in France, that etherization may be employed in a criminal way, for the purpose of destroying life. During the state of sleep it is thought, that ether might be imperceptibly inhaled to a degree sufficient to prove fatal. Experiments on sleeping dogs have shown, that the toxic principle may be so gradually introduced, as, without producing excitation sufficient to arouse the animal, to cause a depression and extinction of the vital functions. An instance occurred in Edinburgh some time since, of a young woman found dead in her bed, without marks of violence, surrounded with fragments of a vessel of ether, and with a strong ethereal odor. The proof of death by etherization in this case is not perfectly satisfactory; but the possibility of such an occurrence is rendered credible, not only by the experiments just mentioned, but by the well known effects of ether on the nervous system. The medical profession should therefore be aware of such a possibility, and make themselves acquainted with the consequent phenomena, in order to detect them. These would be the negative symptoms from the absence of marks of injury, or dis-

case ; the effluvia of ether, either external to the body, or in the blood ; the appearances of cerebral excitement, such as injections and extravasations of the arteries, congestions of the veins, congestion in the lungs, injection upon the mucous coat of the stomach, and perhaps dark color in the blood.

The phenomena of fatal etherization in the human body having been noticed in a single instance only, and those from experiments on animals not being exactly applicable to man, we must wait for future observation to afford us such appearances, as might implicate the life of an accused individual.

In order to prevent the criminal use of ether, it has been proposed in France to pass an ordinance, to prohibit the sale of ether excepting under the prescription of a physician.

I feel obliged to mention another abuse for which this article may be applied. A recent Paris medical gazette contains an account of the administration of ether to a young woman by a dentist, who availed himself of the state of insensibility for the accomplishment of an infamous purpose. The individual accused was in the hands of the police, but the trial not having come on, we are not yet informed what were the real facts. No physician or dentist should think of etherizing a female, unless attended by one of her friends ; and no female should allow herself to be placed in this condition, without the attendance of such a companion.

V.

When the use of ether in surgical operations was first proposed, some distinguished physiologists and surgeons considered it as pernicious or useless. The most enlightened of these, guided by a philosophical spirit, investigated the matter for themselves, became satisfied by the amount of evidence which experiment yielded, and with the exception of a few, ultimately relinquished their objections, and adopted the practice. The natural obstacles to truths so very remarkable having given way, the doctrine poured like a torrent through all the countries of Europe. In this part of our country the apprehension of difficulties and dangers was immediately subdued by the accumulating host of successful experiments. Amputations, extirpations, the breaking down of ankyloses, the reduction of fractures and dislocations, and a multitude of other surgical manœuvres painlessly executed, soon swept away all doubt.

In order to form a proper estimate of the value of the new practice, we should endeavor to realize the men-

tal condition which precedes a surgical operation. As soon as a patient is condemned to the knife, what terrors does his imagination inflict! how many sleepless nights, and horrible dreams, and sinkings of the heart does he experience! what apprehensions of dangerous bleedings, of wounds of vital parts, and even of sudden death does he paint to himself! And when to these is added the dread of insupportable pain, what a frightful picture presents itself to his mind! No wonder that many persons are unable to bring themselves to submit — no wonder that some, wrought to desperation, are led to anticipate their sufferings by a voluntary death. Horror of the knife led a gentleman in this city afflicted with a stone in the bladder to commit suicide. When the terror of corporeal suffering is taken from this load of apprehension, the patient may indulge a hope, which leads him to submit cheerfully to uncertain dangers.

AMPUTATIONS.—In amputations, since ether has been employed, we have never had the unhappiness to witness an instance of the agonizing screams, before so painful to our ears. A few minutes of inhalation have caused the patient imperceptibly to glide through these operations.

An amputation of the thigh was done by Dr. J. M. Warren, July 14, 1847, on a patient filled with apprehensions, and barely recruited from the effects of a distressing accident. Five minutes of etherization threw him into a profound insensibility, from which he shortly awoke to discover that his limb was removed, without any accompanying sentiment but a dream of delightful strains of music. In this case, as in many

others, one of those phenomena occurred, which has been already pointed out. The femoral artery was tied without any movement; ligature of the smaller arteries caused a shrinking, as from pain; when a sponge was passed over the large muscular flaps, cries and violent startings were elicited. Yet this man declared afterwards, that, although he knew when these last operations took place, none of them were attended with any painful sensation. He slept soundly all that night and on the next day was seen sitting up in bed, reading the newspaper, as if nothing unusual had occurred to him.

An amputation for an accident necessarily fatal exhibits not less distinctly the propriety of the practice. A laborer whose limb had been crushed by the wheel of a rail car, was brought to the Hospital in a mutilated state, and it was judged that the only hope of safety rested on a speedy amputation. His ignorance, stupidity, and state of intoxication, led him obstinately to refuse to submit, and all the means of persuasion having been exhausted, it became necessary to leave him for the night. On the following morning having rallied a little under the use of stimulants he was etherized, carried to the theatre, his mangled limb removed and dressed. He survived three days, and on the morning of the third, informed his relations, standing at the bedside, that the doctors had wished to amputate his limb, but that he had refused to give his consent, and died soon after, apparently without knowing it had been removed.

At least twenty amputations have been done under

our eyes without the slightest pain, and generally with rapid recoveries.

EXTIRPATIONS. Of the numerous instances of partial or total extirpation of the mammary gland two have been already described, both belonging to the class, in which, while intellect continued, the patient declared there had been no pain. We will here specify a perfect case attended with some peculiarities, in which pain and intellect were equally suspended.

A married lady, of delicate constitution, submitted to my examination, a tumour of the right breast, two years ago. So small and irregular was it, that any apprehension of its terminating in a malignant affection appeared groundless, and she was therefore advised not to think of it. Gradually, however, it increased, became tender, painful, quite hard, and exciting much anxiety, its removal was ultimately advised, and was accomplished in May, 1847. Etherization by the sponge was perfectly effected in two minutes. The tumour removed was found to be hard, not scirrhous, insulated by a sac, and the patient awoke from an agreeable dream with the satisfaction of having been relieved without her cognizance. Ether has been thought to be contra-indicated where there is a tendency to cephalic derangement; but in this case, a headache, to which for some years this lady had been a victim, was suspended till five days after the operation, and then recurred without unusual severity. The immense benefit from avoiding the shock of severe pain on the nervous system in so delicate a person was considered as more than a balance for a transient pulmonary inconvenience.

ANCHYLOSIS, as a frequent consequence of fracture near or in an articulation, is distressing to the patient, and often embarrassing to the surgeon. The most happy results from ether have occurred in a number of these cases, and the bad consequences of this sequel may be considered as less formidable than they used to be. The great suffering from tearing away the newly-formed adhesions, and the apprehension of subsequent inflammation have often prevented the application of the force necessary to restore the movements of the disordered limb. This may frequently be accomplished in the most satisfactory manner without pain, and so far as our present experience extends, without that degree of inflammation, which is known to have frequently followed this practice.

Dr. Bell, the able superintendent of the McLean Asylum, a department of the Massachusetts General Hospital, conducted to the latter institution a young lady, who had two months before met with a severe injury of the left elbow, followed by a loss of the rotatory movements of the hand, and in a great measure of flexion and extension of the fore-arm. After an examination in the presence of my colleagues, I judged the accident to be a dislocation of the upper extremity of the radius on the external condyle of the os humeri, and in this opinion Dr. Hayward agreed after examining the arm.

The patient and her friends were then informed, that the movements of the joint might be improved by frequent and long-continued efforts of rotation of the hand and flexion of the fore-arm ; that the more certain and perfect method of attaining these objects was by forcible

rotation of the radius with violent flexion and extension of the fore-arm, but that this last practice would be attended with very severe pain. While we were still doubting which course to pursue, the thought of etherization occurred, and was suggested to the patient, who with the advice of Dr. Bell immediately assented to it. A sponge was used, and in two minutes she was asleep. Seizing the lower extremity of the os humeri with the left hand, with the right a combined movement was accomplished of rotation of the hand outwards, elongation of the fore-arm and extension or straightening of the elbow-joint. By these means the head of the radius was brought into its place; then by a forcible flexion of the fore-arm the remaining adhesions were broken down with a distinct crackling.

No motion or sign of pain was exhibited. In two or three minutes the patient awoke smiling, as if something agreeable had passed through her mind. She was then asked, whether she felt disposed to an operation for the relief of her arm, to which she replied affirmatively. Being desired to make such movements as she was able, she raised the arm, and to her great surprise and gratification found all its movements restored. She got well without any important inflammation.

A female patient in the Hospital, who had recovered from a fracture of the surgical neck of the os humeri, having a consequent inability to elevate the arm above a horizontal line, was etherized by Dr. H. J. Bigelow, whose patient she was, and he then politely invited me to operate on the arm. The scapula being firmly sup-

ported, the os humeri was gradually elevated till it came in contact with the side of the head, with an audible rupture of the adhesions. Anterior, posterior and rotatory movements were then freely made—all without the slightest shrinking, and the patient awoke with a smile. This occurred in the presence of Dr. Page, of Philadelphia, Dr. Smith, of the Navy Yard at Charlestown, and other gentlemen.

The son of my gardener falling from a tree fractured the internal condyle of the os humeri, and dislocated the fore-arm. The dislocation was reduced by Dr. Wild, Jr., of Brookline, under whose judicious treatment the violent inflammation which followed was subdued, and at the end of a month the limb was restored nearly to its natural size. The severe articular inflammation was followed, as it usually is in such cases, by partial ankylosis. The boy was unable to move the arm more than four or five degrees. Finding that his condition did not improve, it was agreed in a conference with Dr. Wild, that the adhesions should be broken down under the influence of ether.

At the end of seven weeks from the accident the patient was brought to my house by Dr. Wild, and the operation was performed with his aid: Drs. Wyman, Parkman, and J. M. Warren, were present. Etherization was slowly effected, the application of the sponge being required for about ten minutes. The upper arm being firmly held, I operated with the fore-arm as a lever, and produced forcible flexion. The resistance was so great, that at first it seemed impossible to overcome it, but by continual efforts it yielded with a loud crack-

ling, which almost alarmed us. The fore-arm was brought to extreme flexion, and then to extreme extension without any emotion of the patient.

After his recovery from etherization he had much pain till the next day, and the swelling seemed to call for the application of leeches. But before they were applied it subsided, and he had subsequently no unpleasant symptoms. Under the persevering use of passive movements the limb is gradually recovering. The disposition to regeneration of the adhesions in such cases, and the consequent stiffening of the joint, often render a repetition of this process unavoidable.

The common treatment of fracture of the condyles of the os humeri is by the application of close splints and bandages ; and I would remark, (not in reference to this case, which was treated exactly as it should have been) that the practice generally recommended is pernicious, because it is adapted to favor the worst consequence of this accident, namely a loss of the power of bending the elbow.

Every surgeon knows, that when a fracture extends into a joint, the effusions of cartilaginous and osseous substance, and the adhesions they produce in and about the articulation, impair its motion in a greater or less degree. To prevent this ill consequence it is advised to take off the splint, and move the arm, at the end of two weeks ; but in the mean time the causes above mentioned, with confinement of the limb, render the movement so painful, that the patient resists the operation, and for a time it is abandoned. On the next attempt these difficulties are still greater. It is therefore thought

better to leave the limb to itself till the inflammation has wholly subsided, but motion cannot at this period be accomplished without violence. Further it may be said, that where there is no dislocation, there is no need of splints, nor bandages. The fractured condyle, if displaced, cannot ordinarily be restored to its proper situation, and splints are not required to retain it in its new position, for it will retain it without them.

The practice in this accident should consist in applications destined to prevent inflammation, as leeches, cold water, etc. The arm should be left free from every impediment to its movement, and when the inflammatory symptoms are not alarming, the patient should be compelled to give it motion in three or four days after the injury.

A young man appeared at the Hospital having an ununited fracture of the thigh with two inches of shortening, the result of an accident which happened two months before. An extending apparatus was adjusted, the patient etherized, and extension being made, the limb was elongated. By the continuance of the process the natural length was restored, with the exception of half an inch, and a firm union was obtained. Notwithstanding various precautions, the long confinement of the limb in one posture was followed, as frequently happens, by absolute immobility of the knee-joint. Etherization was employed, and then requesting my colleague, Dr. Townsend, to grasp the lower part of the thigh-bone, I made forcible flexion till the leg and thigh came in contact. This was accompanied with a crepitation so loud, as to be heard throughout the ward. In a quar-

ter of an hour after I found the man in a violent fit of crying, from the impression that his bone had been again broken. On the following day he had recovered from his apprehension, and experienced only a moderate degree of pain and swelling. He soon regained the use of his limb, and was able to walk with a slight halt.

In rupture of the adhesions from ankylosis a great advantage is gained from the state of insensibility, because it prevents the patient from a natural and involuntary counter-effort of muscular contraction, in order to resist a movement he knows will give pain. It may be said, that in all these cases the application of force is unnecessary, because the use of the articulation would be gradually acquired without it. But besides the loss of time, amounting to weeks, perhaps to months, it is doubtful, whether so much motion would ever be recovered, as may be at once attained by the immediate destruction of the adhesions.

FRACTURES in general do not require the application of great extending force for their reduction. In some, however, the limb being shortened by muscular contraction, the resistance thus opposed cannot be overcome by physical force without a violence both painful and dangerous to the patient. Fracture of the thigh affords an example. In this accident, the broken pieces are commonly displaced and overshot, partly from the circumstances of the injury, and partly from the obliquity common to this and most fractures of the long bones. The overlapping bones must be brought to correspond at their extremities, in order to prevent shortening, deformity, and difficult union ; but this is opposed by

the powerful contraction of irritated muscles. Ether enables us to annihilate these contractions, and bring the limb without pain to its proper situation.

The patient having been put to sleep, the surgeon extends the limb, brings the fragments to their natural relations, applies permanent extension and counter-extension, and supports the whole limb by lateral pressure, especially about the fractured part; if afterwards displacement occurs, he repeats the same process. At the end of five or six weeks, he attempts to overcome the stiffness of the knee-joint by flexion of the leg, and when, as often happens, this cannot be accomplished without severe pain, it can be done most happily in the etherized state. Nearly the same method may be pursued in the treatment of fracture of the neck of the thigh bone.

In overshot ununited fractures of some duration, the difficulties are greater, but even these may be overcome if too long a period since the fracture has not elapsed. This is shown by the case last described, (page 43,) and another may here be adduced with circumstances somewhat different.

In the winter of 1847, a man met with a fracture of the upper third of the thigh bone, with a shortening of between two and three inches, and an anterior projection of the upper fragment. Great pains were taken to restore the length of the limb, and remove the deformity. The straight posture, the flexed, the apparatus of Jarvis and bed of Amesbury were successively tried; but all these plans were abortive, because the patient could not bear the requisite pressure, and two

months elapsed without union. After a little respite, to allow the healing of excoriations, etherization was resorted to, the limb brought down by an extending apparatus, and the same process repeated, when the bones became displaced at various times afterwards; compression also was applied to the upper fragment, and a cure accomplished with a very slight shortening.

Whether the sensitiveness of this man was modified by the inhalation, or by any other cause, we pretend not to say. Certain it is, that after the first application, he never suffered severely, and we were all struck with the fact, that this man, so irritable before etherization, became quiet and docile afterwards.

DISLOCATIONS.—The advantages obtained by muscular relaxation in fractures, as noticed above, are equally great in the reduction of dislocations, since the principal impediment in these cases arises from the same cause. It is therefore scarcely necessary to illustrate them by other facts. But it may be stated, that two cases of dislocation of the os humeri were immediately reduced by Dr. Parkman, one of the surgeons of the Hospital, under the influence of ether, one of which had already resisted powerful efforts for reduction without ether. We have great hopes of hereafter seeing some of the difficult dislocations of the hip and shoulder, hitherto the opprobria of surgery, compelled to submit to the power of ethereal relaxation.

The remarks before made on the muscular relaxation from ether satisfactorily show, that by it we produce a condition of the muscles, which permits extension with a moiety of the power otherwise required.

OPERATIONS ON THE BONES.—The bones are the subjects of severe, long-continued operations, from the shock of which the patient sometimes sinks. Three instances of operations on the bones may be noticed, happily conducted by the aid of ether.

First, a necrosis of the tibia of two years standing was submitted to the hands of Dr. Townsend, while knowing that the etherization must be carried to a great extent, I carefully watched its effects. An incision of six or seven inches, a number of sections of the enclosing new bone, and the removal of many portions of sequestra required a period of forty-five minutes. Etherization by a sponge was continued with very slight interruptions for thirty minutes without suffering, but the patient's pulse failing at the end of this period, it was intermitted, and he awoke soon after. Immediately he became very restless, and with many odd remarks, clamorously demanding "divine ether," it was given for nearly fifteen minutes longer. The operation was happily concluded. The man continued very gay for a couple of hours, experienced no bad effects, and recovered rapidly.

The second case was one of ununited fracture of the radius, treated by a seton. This patient had broken his fore-arm about six months previously; the ulna was consolidated, the radius remaining ununited. What produced this result was not ascertained. As the man was perfectly healthy, it could not be attributed to a constitutional difficulty, but the probable cause was his movements of the hand in rotation during the treatment.

The arm was left for some time without any application, except stimulating frictions adapted to restore a healthy condition, and then a seton was introduced. The direction of the fracture was such, that the passage of the needle across from without inwards would cause it to impinge on the ulna. In order to avoid this difficulty, a dissection was made on the anterior face of the radius. The needle could not, however, so close was their junction, be forced between the extremities of the fragments. It therefore became necessary to divide some of the adhesions with a knife, and to open a passage by a small chisel, aiding this process by such a posture of the arm as seemed most to favor it; then the needle, being passed from without inwards, and from before backwards, was made to issue behind the ulna. From ten to fifteen minutes were required; etherization by the sponge was continued through the whole operation, and the patient awoke after its removal, in a happy state.

Inflammation succeeded, with symptoms so violent, that the seton was withdrawn in ten days—a period too short, as was afterwards found, for perfect success; the motion, though diminished, being perceptible at the end of seven weeks. After this time, it rather increased than diminished, and another operation was required. The patient was etherized as before; an incision, about two inches long, made on the outer edge of the fracture; and at a right angle with this, another incision, an inch long, over the back of the radius. The fractured extremities being well exposed, their ligamentary adhesion was divided by a knife, and a

peg of ivory, two inches long, passed between them. Then, in conformity with the advice of Dieffenbach, a hole was bored in the extremities of the upper and lower fragments, and a peg inserted in each. The patient was quite awake through the process, and talked humorously, but did not acknowledge pain; thus presenting distinctly one of the instances of the existence of the intellectual faculties with the absence of the sensitive; and affording, of course, a distinct objection to the hypothesis of Mons. Longet, which maintains that the cerebral lobes are always etherized before the sensitive ganglia.

In the preceding case, slight variation in posture favored the passage of instruments, which without it could not be made to penetrate. I noticed the same fact in two such operations on the os humeri, performed during the last year with a successful result; one of them on an attendant of the Hospital, the other on a female about forty years old, in whom the brachial artery, interfering with the passage of the needle, required a dissection to remove the vessel from its course. It may be useful to remark, that in the last case, as well as some others, I have seen the want of union to be the result of an application of splints and bandages so close and long continued, as to check the action of the blood vessels and nerves.

Sir Benjamin Brodie, in one of the valuable practical papers with which he so often favors the public, speaks of a number of cases of ununited fracture attributable to general debility. Such cases I have also seen; but those which have occurred within the last two or three

years have arisen principally from local weakness, caused, as I have said, by too great pressure from splints and bandages.

The third of these cases was that of a young Portuguese seaman, who had a fracture of the leg at sea, about a year before. On the outer side of the leg, in the situation of the upper part of the fibula, appeared a considerable projection, such as might be formed by an extraordinary effusion of osseous, cartilaginous and fibrous substance. The patient could not use his limb, but his most urgent reason for asking aid was, that he experienced incessant pain in the enlarged part. Many applications were made without mitigating his sufferings.

Having been requested by Dr. Townsend, whose patient he was, to examine the limb, I suggested the expediency of cutting down to the bone, in order to ascertain what the nature of the difficulty was, whether the peroneal nerve might be compressed by the bony matter, whether there might be a collection of fluid, an aneurismal formation, or other disease of the bone. To this proposition Dr. T. kindly consented, and I made an incision four inches long on the outside of the fibula, along the surface of the tumour, and on a line from the head of the fibula downwards towards the malleolus. The peroneal muscles were separated, dissected from the surface of the tumour, and with them a large branch of the peroneal nerve lying in contact with the bone. The parts were held aside, in order to expose the tumour more fully — a process which would certainly have been very painful, if the patient had possessed his sense of feeling at the time.

The bone was then penetrated by a perforator, to the depth of an inch. The perforation being enlarged, so as to admit the little finger, disclosed a cavity, two or three inches in length, lined by cellular parietes, constituting the disease known by the name of *spina ventosa*, or osseous sero-cystic tumour. As there was no sign of malignity, the proceeding which seemed best, was to remove the externo-lateral wall of the bony tumour, in the hope of relieving the pain produced by its pressure on the surrounding parts; leaving the question of amputation, and that of excision of the whole bony tumour, to be decided by subsequent events.

The operative process, including some intermissions for consideration, lasted nearly thirty minutes. The patient was perfectly insensible through the whole, in consequence of the continuous application of the sponge. He awoke in a pleasant state of mind, and had no bad effects from the ether.

After the wound had healed, pain recurred, and the tumour regularly enlarged. The peroneal branch of nerve on its surface became inflamed, so that the slightest pressure on it was insupportable, and the outside of the foot and leg occasionally lost their sensibility. It now seemed necessary to remove the diseased bone; but this could not be done without the destruction of the peroneal nerve and artery, and also, the interosseous space being occupied by the tumour, of the anterior tibial artery and nerve. The consequence of these lesions would have been paralysis of a good part of the limb, and probably a gangrene which would involve the whole, and perhaps prove fatal.

It was determined, therefore, to amputate the tibia at the place of election, and excise the whole fibula. This was accomplished, a good flap procured from the posterior part of the limb, and the patient is now recovering.

The diseased part of the bone was found to be six inches long; its circumference was nine inches. It contained a single cavity filled with yellow serum, which on opening the tumour was projected between two and three feet—thus showing it had exerted on the bony cavity and its membranous lining a strong pressure. The aperture made in the first operation had been closed by a fibrous membrane.

This patient required at least twenty minutes for etherization. At the end of this time, he was insensible, and experienced no bad symptom from ether afterwards.

STRANGULATED HERNIA.—One of the earliest thoughts that occurred after the introduction of ethereal inhalation, was its applicability to strangulation of the viscera. In various amputations, we noticed a loss of contractile power in the muscles while etherization continued; and this observation was confirmed by a number of other etherized cases, in which the muscular contraction first occurring was succeeded by remarkable relaxation. Hernial strictures caused by, or connected with, a state of muscular contraction, might be expected to relax under the same influence, and allow the return of protruded organs. The use of tobacco, the warm bath, and copious bleeding, have been employed with this intention. Even the organic muscles may be affected

by such influences; and hence, no doubt, arose the suggestion made by Nysten, of the usefulness of ether in colic — a suggestion made in the history of the first six cases of etherization, without a knowledge of its mention by Nysten.

Two cases only of strangulated hernia treated by ether have come within our experience, one of which we shall mention.

In the month of June, 1847, Dr. J. M. Warren was called in consultation to a female patient, laboring for eight days under strangulated crural hernia. She had fœcal vomiting, great tension of the abdominal muscles, with much pain and tenderness in the tumour. Taxis having been unavailingly attempted, she was placed under ether, preparatory to an operation. The abdominal muscles previously tense were entirely relaxed, pressure on the tumour was made without pain, and the hernia readily reduced.

Notwithstanding the long period of strangulation, she recovered — a fact which would be more surprising, had we not frequently noticed it in strangulated crural hernia. In looking for a cause of this occurrence, we have been led to impute it to the comparatively small volume of this species of hernia.

My friend, Dr. Hosack, of New York, has given an account of a strangulated hernia reduced by ether, in the Boston Medical and Surgical Journal, of August 11, 1847.*

* A fact occurred at the time of writing these lines, which may be worth mentioning. Dr. Wales, of Jamaica Plains, brought to me a little Irish infant, three months old, with a

FEIGNED DISEASES.—Ether has been employed successfully to detect the imposture of feigned diseases. In Europe it is not uncommon among the poorer classes to find individuals who, in order to excite compassion, obtain charity, procure admission to a hospital, or avoid some unpleasant requisition, feign contractions of the limbs, deafness, inability to speak, etc. Etherization overpowering the will which maintains these appearances, the contracted muscles relax, the deaf man hears, and the dumb speaks. Although such impositions are comparatively rare in this country, we have occasionally seen them, and had opportunity of observing the temporary restoration of limbs affected with distortions, which before seemed permanent.

TETANUS.—Etherization may be employed for the relief of tetanic spasm; but while it mitigates the distress of the muscular contractions, it cannot be expected to overcome the inflammatory action of the spinal membranes, or the medulla they envelope.

NEURALGIA.—The paroxysms of neuralgia may be relieved by ethereal inhalation, and great comfort obtained by the interruption of long fits of this affection. Sometimes the paroxysm is quite broken up; but I have seen no instance of a final cure. Such, however,

large congenital strangulated inguinal hernia, of two days' duration. After examining the tumour, I was about to etherize the child, when it fainted, and appeared to be in a dying state. The proposed etherization was suspended, and while awaiting the event, we heard a movement of the bowels; the hernia retreated, an evacuation followed, the patient revived, and did well. In this instance, the state of faintness produced a muscular relaxation, which removed the impediment to the return of the viscera.

I have strong hopes, may hereafter occur, as the result of a patient and repeated use of this practice.

STRICTURES.—Spasmodic or inflammatory contractions in muscular tubes destined for the admission of alimentary substances, or for the expulsion of excrementitious matters, constitute a class of affections often very difficult to overcome. Organic strictures, or those which result from an adventitious deposit of healthy or morbid particles, would scarcely seem to come within the limits of ethereal practice — yet I have seen even in these cases good effects from its influence.

In the latter part of July, 1847, a gentleman applied for a difficulty in swallowing, as he called it. His food, he said, passed down to a certain point, and after being retained there for a while, was rejected. Suspecting he had a stricture of the œsophagus, I attempted to introduce the balled probang, but found it impossible; the sponge was then put to his nostrils. In two minutes, the patient repeatedly spoken to did not reply. The instrument was now passed down as far as the stricture without excitement or movement, carried through it, and moved up and down three or four times. The movements through the stricture excited œsophageal and gastric contractions by reflex action, without awakening intellect. After the removal of the instrument, the patient being spoken to, awoke, and said that he had no knowledge of its introduction. Graduated globes and pyramidal wedges were employed many times afterwards; and when, as often happened, the stricture resisted the passage of the instrument, it was overcome by etherization. The patient was re-

lieved, and returned home, with instructions for a continuance of the process.

Stricture of the urethra, producing retention of urine, is a very fair subject for the practice. When this retention has continued long, a great accumulation of urine taken place, accompanied with much suffering, after a succession of ineffectual efforts, the surgeon is, by a natural impulse, tempted to a forcible use of instruments, and the frequent consequence is a disorganization of the urethra, from which it never recovers. Experience has taught, that when moderate and judicious trials of bougies and catheters do not succeed, these instruments should be laid aside, and the patient left to the action of those remedies which subdue inflammation and produce relaxation. Leeches, the warm (sometimes the cold) bath, and narcotics, will often succeed, with the help of nature, where instruments have failed. Etherization is here a happy auxiliary, as may be illustrated by the following case.

Dr. J. M. Warren was called in consultation to a gentleman, who had suffered from a retention by stricture for ten or twelve hours. It not being possible to pass an instrument without violence, leeches, the warm bath, opium, etc. had been ineffectually used. Great distension of the bladder having taken place, attended with extreme suffering, it was agreed to etherize the patient before any further efforts were made. As soon as etherization was accomplished, a few drops of water began to trickle away, and the instrument was passed without difficulty. The passage being open, no further obstruction occurred, and he recovered in a few days.

The following case also illustrates the power of etherization in causing relaxation of the urinary passages. In the month of October, 1847, a man was brought into the Massachusetts General Hospital with an infiltration of urine. The bladder had ruptured apparently in the perinæum, and the urine had infiltrated the scrotum and abdominal parietes to a great extent.

The state of the bladder was explored on the surface of the abdomen and in the rectum. The abdomen was extremely distended, but on its right inferior side was found to be soft, and this fact led to the inference, that the abdominal hardness was not caused by distention of the bladder. This point being settled, I next proceeded to examine the state of the urethra, and as the patient was very sensitive, and in great pain, he was etherized. Instruments passed into the canal were, as I expected, interrupted, none could be made to approach the bladder, but immediately after etherization there was a discharge of urine by the urethra. On examination by the rectum the bladder was not discovered, but a collection of knotted tumours was found behind the usual situation of the prostate gland. There was then no distention of the bladder, and of course no occasion for its puncture.

The most important thing to be done under existing circumstances, was to relieve the infiltration as much as possible, by giving vent to the urine in the cellular texture. I therefore made an incision in the most dependent part of the scrotum, on each side of the raphé, and full two inches long. The patient was ordered into the warm bath, had warm injections into the rectum,

and etherization once in six hours. On each etherization there was some discharge of urine from the urethra.

On the day following, however, the symptoms were aggravated, there was great distress, great prostration, the scrotum black, the abdominal swelling increased, extended over the left flank to the spine, and covered by an erythematous eruption. The man's case seemed to be nearly desperate. I determined then to make a large incision through the abdominal swelling, and to penetrate the tumour wherever it was.

The patient being again etherized, an incision three inches long on the prominent part of the tumour, followed by a careful dissection, at length produced a small jet of urine. The aperture being widened by a probe, was then freely dilated, and a copious urinary discharge, accompanied with flocculent lymph, followed. The bed was inundated. The finger passed through the aperture, discovered a large cavity extended over the left portion of the abdominal parietes, and towards the scrotum. It now only remained to procure a dependent opening for the urinary fluid. In order to accomplish this, a lithotomy-staff was passed through the abdominal incision into the left scrotum, then insinuated from within the scrotum outwards through the scrotal incision made the day previous. On the staff the cellular texture of the scrotum was divided the length of the external incision. By means of this, a free drainage of all the stagnant urine was obtained ;— the symptoms were immediately alleviated. On the day following, there was no suffering ; he took nourishment, and appeared convalescent.

This patient seemed to be doing well for the six days following. On the seventh, he began to fail, and on the eighth died, without any new symptoms which could account for his death. On examination, the vesiculæ seminales, vasa deferentia, and ureters were found to be indurated — the latter were enlarged through their whole extent. One of the kidneys presented various cavities, produced, no doubt, by revulsion of urine from the bladder. This organ was very much contracted, its mucous coat ulcerated, and in one or two points this coat formed hernia, from the powerful contractions of the bladder on its contents. The rupture of the urethra was a little in front of the bulb, and about half an inch in length. Before the rupture appeared its cause, a membranous prolongation stretched obliquely across the urethra.

In this case, ether operated favorably in two ways; first, by occasionally producing a small flow of urine; and second, by the absolute rest it induced during the second operation, in consequence of which, a dangerous and uncertain dissection could be made with perfect tranquility.

LITHOTOMY.—This is an operation whose terrors may be greatly diminished by ether. The exquisite suffering, the spasmodic constriction of wounded muscles, the irregular pouch-like contractions of the muscular coat of the bladder, under its use, must cease to act as obstacles, and their cessation give an ease and freedom of mind to the surgeon, which might enable him to encounter other dangers with confidence that he can subdue them. The stone in the bladder, as I have had

occasion to notice, is so exceedingly rare in this region, that during forty-five years I have not encountered as many instances, including together cases of lithotomy, lithotritry, and those not subjected to any surgical operation. And since the introduction of etherization, I have not had occasion to perform the cutting operation. For, although called on to do so, I have been able to avoid its dangers by the operation of lithotritry with happy results. This, however, brings its peculiar difficulties and dangers; the latter never in my practice amounting to any thing formidable, but the former much exceeding in extent those of lithotomy. The irritable state of the urethra, the great sensibility of the bladder, the partial and general contractions of the vesical muscles, the lodgement of broken fragments in the urethra, the tedious repetitions sometimes required concur to embarrass the surgeon, and render his approach to this process less agreeable than to the more dangerous one of lithotomy.

Among the occurrences of lithotritry, the most troublesome of those already named is a partial contraction of the bladder. When the operation has been frequently repeated, I have had occasion to notice, that the stone-breaker, after seeming to enter the cavity, and after having actually entered the prostatic portion, could not be brought into contact with the stone; and on passing the finger into the rectum, it has been found that the instrument was arrested immediately beyond the prostate, by impinging against the vesical tunics, crowded down towards the urethral aperture by a contraction apparently resembling the hour-glass contrac-

tion of the uterus. By the aid of a finger in the rectum, the instrument may be conducted in such cases into the superior region, and the stone thus attained. Those expert in lithotrixy may perhaps believe, that this difficulty might be obviated by a sufficient distention with water; but they will recollect, that this distention, even though moderate, produces a painful disposition to expel the liquid, and that it often is expelled in a very short time, especially in females. So often has this occurred, that I have been led to apprehend, that the stone may generally be seized with as great facility, and as little danger of including the vesical coats without, as with, this preparatory step. Dr. Randolph, the most able lithotrist of this country, has, I think, the same opinion. Etherization is especially adapted to obviate the accident alluded to.

A gentleman applied to me to perform the operation of lithotomy on himself. He had been examined, and a stone found; but the consequences of this examination, although it had been carefully conducted, led him to the conclusion, that he could never submit to the irritating repetitions of lithotrixy. After a full conversation with him, he agreed to undergo another examination under the influence of ether; and so far from suffering while it was made, he described his sensations to be altogether pleasurable. No irritation followed, and shortly after he underwent lithotrixy. The stone, about the size of an almond, was crushed, and the greater part of it removed by a single operation: a second completed its demolition. The whole process was without pain; and the patient speedily, and

to himself unexpectedly, was restored to health and usefulness.

The following case will further illustrate the use of ether in favoring the exploration of the urinary bladder, when a stone is suspected to exist. Dr. J. M. Warren was requested by Dr. Morrill to see a little boy, four years old, who had symptoms of stone. The child was utterly intractable, until by the application of ether he was put to sleep, and then an examination being made, resulted in the discovery of a stone in the bladder.

As this disease scarcely ever occurs here, it was a matter of interest to ascertain, whether any accidental cause might have given origin to it. The only known occurrence, to which the concretion could be attributed, was the following. The child was passing his water in the street, and, while doing so, was thrown down by another boy, and dragged over some gravel. On the following day he complained so much, that his mother examined, and found a gravel stone in the urethra, which she removed. In four months afterwards, he began to exhibit symptoms of stone, which have continued to increase in violence for about two years and a half.

The symptoms became so distressing and so strongly indicative of stone, that it was thought necessary to make an examination. Such was the pain, that violent contractions of the bladder took place, accompanied with protrusion of the rectum, so that no examination could be accomplished until ether was employed, when a sound was introduced, and a gritty substance discovered. The examination did not, however, give full

evidence of the nature of the affection, and required repetition at three different times. In each instance, etherization was employed in the most satisfactory manner.

On November 16th I saw the boy with Dr. Mason Warren and other gentlemen ; we all became satisfied of the existence of a very small stone in the bladder. The smallest lithotrity-instruments would not pass the urethra. The operation of lithotomy was therefore immediately performed by Dr. Mason Warren by the crescentic or bi-lateral mode, and the stone removed. Ether was invaluable during the examination and operation.*

In this connection may be noticed operations for vesico-vaginal fistula, generally very painful and very unsuccessful. These operations have been performed by Drs. Hayward and J. M. Warren, with perfect freedom from suffering, and hence greater facility afforded in bringing the parts into view, and allowing of their more perfect adjustment.

OPERATIONS ON THE RECTUM.—Painless applications of ligature in hæmorrhoidal and prolapsed excrescences of the rectum, operations for fistula in ano, and other diseases of these parts, might be mentioned ; but not presenting any thing remarkable, we shall pass them over.

CAUTERY.—The actual cautery is viewed with so much dread in this country, and I believe also in Great Britain, that we rarely have been able to avail ourselves

* See Appendix C.

of its great benefits. Lately having the power to give the assurance, that it might be employed without the usual pain, a consent has been obtained, which, although at first reluctant and skeptical, has, by many successful trials, now changed to a ready and perfect confidence.

In the month of May, 1847, there being an annual meeting in Boston of the State Medical Society, occasion was taken to invite the members to witness some operations about to be performed in the hospital.

After two operations with etherization, which succeeded perfectly, a delicate female, laboring under a disease of the spinal marrow with general neuralgia, was subjected to the actual cautery. A space on each side of the dorso-lumbar region of the spine was cauterised by red-hot irons, one of which was an inch square, passed up and down slowly three times on each side without the slightest suffering.* All were struck with admiration at this result, and none more than myself, although I had witnessed it before. In truth it may be said, the change of nervous susceptibility by etherization is so very remarkable, that, after all the cases we have witnessed, every new operation with ether excites fresh wonder, and leads one almost to doubt the evidence of his senses.

DYSMENORRŒA.—The pains of dysmenorrhœa, though temporarily relieved by the use of opium, are very distressing to many individuals. The practice of the late ingenious Dr. Mackintosh, of Edinburgh,

* When the iron is heated to whiteness, pain is known to be less than when it is only red-hot; but, as ether was to be employed, this condition was not thought necessary.

promised for a time to afford the desired relief ; but the hopes it excited have now in a great measure died away, and although it is used with various modifications by some practitioners in Europe, and has been partially adopted in this country, the general sense of the profession, so far as I can judge, is not favorable to it. It may be doubted, also, whether the anatomical fact, on which his practice was founded, is generally true. He exhibited to the author a number of specimens taken from patients affected with dysmenorrhœa, in which existed a very contracted state of the os uteri, and to this state he attributed the difficult passage of the uterine excretion. In some very severe instances of this derangement the aperture has been found to be quite as large as in healthy persons.

When a new remedy is brought forward with some little success, our profession naturally fly to it, and employ it with perhaps too little discrimination in a variety of affections. It soon wears out, and is either wholly abandoned, or used to a very limited extent.

Dysmenorrhœa, intractable as it has been under medical treatment, and breaking down as it does the constitutions of many young persons, is a pretty fair subject for judicious experiments, and may perhaps be considered as not exposed to the objection alluded to. As etherization relieves other pains, why may it not relieve the pains of dysmenorrhœa ? It may be expected to do so temporarily at least, and with less ill consequence than opium and most of the narcotics. The results in those cases, in which I have thought proper to recommend it, have not, for the want of time,

been sufficiently numerous to justify any general statement in regard to its utility. They have been, however, so far satisfactory, as to lead to its trial in all severe cases.

An English gentleman, resident in this place, came to me a few months since for information on this subject. He said, that his wife had from her youth been afflicted with atrocious pains at the monthly period. During its continuance, she suffered so violently, as sometimes to produce convulsions. He had, while in England, naturally consulted the most able and experienced practitioners; but as yet nothing had been found to be permanently beneficial, except opium.

Soon after, I had an opportunity of seeing her in one of the paroxysms, and suggested such means as seemed likely to give relief. At the next periodical occurrence, the symptoms being of an alarming character, etherization was employed, the distress was at once relieved, and the paroxysm broken.

Some months after the first application, this patient had another severe and alarming paroxysm of her complaint. Opium and other remedies were employed without important relief. Ultimately, etherization was resorted to, with the effect to mitigate the pains, which, however, recurred from time to time, until a pint of ether had been consumed. The paroxysm did not terminate, until there was an expulsion of a membranous formation, similar to that described by Dr. Oldham in the London Medical Gazette of April 16, 1846.

MIDWIFERY.—The application of ether for the alleviation of the pangs of labour may seem to claim atten-

tion. The reversal of the decree of nature, which in human kind connects suffering with parturition, would indeed be a phenomenon as remarkable as any medical science has revealed. There is no parity between the abolition of pain in surgical operations, and the abolition of the pains of labour. The former is only a part of that action of a general law for preservation against injury, in consequence of which, whenever a foreign body threatens to impair the integrity of an organ, pain is produced, and the organ is instinctively withdrawn from the contact. Hence each organ has its sensitiveness peculiarly adapted to its own protection:—the eye is irritated by an atom which would produce no impression on the skin; the skin is exquisitely affected by the cut of an instrument which would cause little pain in a ligament; while the ligament, unconscious almost of the presence of a knife, is severely pained by those distortions which might lacerate. Nature has thus given to each part a sensibility which warns it of external danger; and by this warning she affords, to a certain extent, the means of escape. A kind provision also for the relief of internal pain and disease is bountifully provided in the copious stores of the *Materia Medica*.

There is therefore nothing contrary to the laws of nature in the removal of pain from surgical operations. Some, indeed, have said, that such pain is, as a final cause, necessary to warn the surgeon of his approach to textures, or organs, it would be dangerous to touch; but this opinion will, perhaps, not bear very close examination. The outer coat of a great artery, for exam-

ple, apart from the accompanying nerves, is not very sensitive ; nor are the pleura, the peritoneum, tunica arachnoidea, dura mater,—all of them organs not to be wounded without danger. Some nerves, whose integrity is essential to life, possess a sensitiveness less than those distributed to parts comparatively unimportant. Dissection of the par vagum from the coat of a tumour is accomplished with less pain, than that of one of the cervico-spinal nerves. The proper guide to the surgeon is not the variable sensitiveness of the organs he is dealing with, but his knowledge of their situation and relation. Suffering, then, is no essential or useful part of a surgical operation.

The law which regulates the pains of labour is a general law, which cannot be changed by the power of science. Its final cause is sufficiently plain to show its utility and necessity. Like most general laws, this, however, may have its exceptions, and we may increase the number of these exceptions by the aid of art.

Besides the objections to the universal application of ether on the grounds exposed above, there are others of a specific character, which can hardly fail to occur in this department of practice. The use of so powerful an application through the whole period of a natural labour would, in proportion to the term of that labour, increase the dangerous tendency to organic excitation ; and when this period is very protracted, it might bring on distressing derangements of the stomach, brain, spinal marrow, or uterus. Another objection to its free employment is, that it does, in many cases, suspend the uterine contractions.

The cases, then, in which ether could be properly resorted to, should be considered as exceptions, and we will specify the following: 1st, in a natural labour, when the pains are uncommonly severe, especially the terminating pains in a first parturition; 2d, during limited periods of labours prolonged by a preternatural cause; 3d, when, from the peculiarity of constitution, the patient cannot, without danger, support the usual amount of suffering; 4th, for the purpose of obtaining relaxation in irregular contractions of the uterus, such, for example, as the hour-glass contraction after delivery.

These suggestions are founded principally on a general knowledge of the effects of ethereal inhalation, and not on the results of my own personal experience. My son has, however, employed etherization in obstetrical practice with results which appear to me in the light of exceptions to the general law.

Among other instances, the following may be mentioned. A lady was ill eighty-four hours, during forty of which she was more or less etherized with great relief, and passed through the terminating pains without any symptom of suffering, or any recollection of them. I had an opportunity of seeing this lady after her confinement repeatedly; found her in an excellent state, and without any unpleasant consequence. Those who wish for particular information in regard to this practice, may consult the publications of Dr. Channing, of Boston, Dr. Simpson, of Edinburgh, and Professor Dubois, of Paris.

DEATH.—A very important use of etherism remains to be noticed. In a former part of these pages, its ap-

plication for the relief of the last distressing state of pulmonic inflammation has been transiently adverted to. Since the establishment of ethereal practice in surgical operations, its former utility in mitigating the agonies of death has led me to employ its influence in a more free and decided manner. And so far as the trials have extended, they serve to justify its use in a great number, and I hope I may say without enthusiasm, in the majority of instances. Should this prove, on a full trial, to be the fact, the value of the discovery will be greatly enhanced, since the number of those who are called on to suffer in the struggle between life and death, is greater than that of those who are compelled to submit to the pain of surgical operations.

I am fully aware, that the agony in the dissolution of the bond between the bodily frame and its spiritual tenant, is not so great as it is believed to be; for, having questioned a great number of persons passing through the last stage of earthly existence, whether they suffered pain, the answer has been almost uniformly in the negative; and on inquiring what sensation was experienced, the reply has been such as to lead me to consider it an undefinable sense of discomfort. The intellectual faculties appear to be so clouded and confused, that they are unable to take cognizance of the agitation which convulses the physical organization.

There are, however, exceptional cases, in which there is great bodily suffering; and there is in all men an instinctive dread of the pains of death. If we find the means of preventing or relieving these pains, the

great change may be viewed without horror, and even with tranquillity. He who would experience a real euthanasia should not, however, trust merely to the virtues of ether, but should also have settled his accounts with this world, and be well prepared to settle those of the future.

In illustration of the practice alluded to, may be mentioned the case of a lady, who died of dysentery in the summer of 1847, at the age of ninety. She had been my patient more than forty years; and during that time, besides heavy domestic calamities, had undergone a number of attacks of pleurisy, one of pericarditis, a severe and protracted bleeding from the stomach, with symptoms of malignant disease of this organ. She was once dangerously poisoned by eating partridge; moreover, by a fall she had a fracture of the neck of the thigh-bone, and soon after her restoration, was attacked with senile mortification of the foot, from which, having suffered months of intense pain, she wholly recovered.

Very temperate in her eating and drinking, and of a religious character, she was cheerful, notwithstanding all these visitations; appeared to enjoy life more as she grew older, went out freely, and made two or three excursions into the country within a few weeks of her last illness.

The dysenteric attack, which terminated her career, accompanied with symptoms of unusual severity, was only relieved for a very short time by the use of opium. After more than two weeks of illness, violent pain occurred in one of the feet, with discoloration,

ending in gangrene. The pain of mortification suddenly ceasing under the use of opium, that of the abdomen returned, with convulsive twitchings of the limbs; and other remedies failing to mitigate these symptoms, inhalation of ether was employed with perfect relief.

From the first inhalation to the period of her death, five days elapsed, during which a considerable number of etherizations were used, and with such effect, that, as soon as any suffering occurred, she desired ether. In the intervals, her mind was clear, she arranged such worldly matters as remained unsettled, received the consolations of religion, and finally under ethereal influence her spirit imperceptibly took its flight.

VIVISECTIONS.—An excellent use of ether may be made in regard to animal vivisections. The people of this country, in common with their English progenitors, have always viewed the torturing of living animals for scientific purposes, with invincible repugnance. Great has been the sacrifice of improvement in physiology and surgery, which this sentiment has cost the medical profession. Ether enables us to lull the sensibilities of the victim, tranquilly pursue the natural workings of the internal organs, and the changes which take place from experimental applications; while the student of surgery can accustom himself to those gushes of the vital fluid, which, in the human body, are viewed with so much terror by the unpractised.

Animals of any size may be etherized in a box, or by covering the head with an India-rubber sack, into which a mixture of ether and atmospheric air is forced.

Dr. B. Brown, of this city, in the spring of 1847, was the first in this country; so far as I know, to employ etherization for the prevention of pain in surgical operations on animals. Latterly, others have satisfactorily adopted the same practice.

GENERAL CONCLUSIONS.—The views we have taken on this subject, suggest the following inferences :

1st. Inhalation of ether produces insensibility to pain.

2d. Ethereal insensibility, judiciously effected, is not followed by any dangerous consequences.

3d. Its administration is easy, and usually requires but a few minutes.

4th. Individuals of all ages may be safely etherized.

5th. Individuals of the same age are susceptible of the influence of ether in variable degrees.

6th. Surgical operations may be done under the effect of ether, which could not be done without.

7th. Operations very short, and not very painful, especially those about the head and neck, are best done without ether.

8th. The shock of the nervous system is greatly diminished by etherization.

9th. The use of ether has increased the number of successful operations, by encouraging a resort to them at an earlier period of disease.

10th. The use of the sponge is more safe and easy than that of any special apparatus.

11th. A special apparatus is convenient for some peculiar cases.

12th. The existence of chronic pulmonary disease rarely forms an objection to etherization.

13th. Etherization may often be employed advantageously as a substitute for narcotics.

14th. The employment of ether does not retard the healing of wounds, nor give them an unfavorable character.

15th. The pains of death may often be relieved by etherization.

VI.

For the most part the horizontal posture is favorable for etherization, because the patient is more easily composed. In the early practice, the tube and bottle being used, the patient almost constantly assumed the upright posture ; but we found reason to believe, that etherization was more speedily and perfectly accomplished in the horizontal, and therefore have made it a general rule to adopt the latter in preference to the former. In some operations, however, as for example in stricture of the œsophagus, this would be impracticable.

The sponge will be found more convenient than any apparatus in the majority of instances, though we think that the mouth-tube may sometimes be proper. The sponge is preferable, because it requires less effort to inhale through it, and because the atmospheric air introduced with the ether removes the danger of asphyxia. Perhaps a longer time is required ; but this is a minor evil, and readily overcome by a little patience.

The sponge should be of an excavated form, in order to accommodate the projection of the nose. The wind-

ing indirect channel of the nostrils, the more natural passage for the ærial fluid, diminishes the impulse on the lungs, and the consequent propensity to a troublesome cough. The sponge previously moist, saturated with ether of the purest quality [vide Appendix A], should be closely applied to the nasal apertures with due caution to prevent the introduction of the fluid into the mouth and eyes; and its position should be occasionally changed, on account of the gravitation of the ether to its inferior part. Some patients prefer employing the sponge themselves, and this is true particularly in regard to parturient females. And so far as our experience has extended, it has given us reason to believe, that the practice of committing the sponge to the patient may be advantageously adopted in a great number of instances. When the lungs are irritated, and cough produced, the sponge may be momentarily removed.

The volatility and combustibility of ether should be kept in mind when it is employed by candle-light. Although there is no great reason to fear an explosion of the lungs, it is quite possible that the patient and the surgeon might be unpleasantly burnt by the careless approximation of flame. A patient of mine had been advised to apply a bandage dipped in ether for an affection of one of his fingers, and having secured the bandage by a piece of thread, in the absence of a cutting instrument burnt off the string by the candle, in consequence of which he experienced something of a cauterization.

The quantity of ether employed has been thought to require exact measurement; and, among others, the ce-

lebrated surgeon and author, Monsieur Bonnet, of Lyons, has invented an apparatus for accomplishing this purpose. The proper measure of quantity is its influence on the patient; and this influence must be obtained, whether it require drachms or ounces. As a matter of economy the measuring apparatus would be useful.

It is to be taken into view, that the quantity of ether inhaled is gradually diminished by the reduction of temperature from its evaporation. The salivary excretion from the mouth is sometimes seen frozen on the sponge by cold from this evaporation. The ether in the sponge will of course become colder during the application; its volatility, and therefore the quantity inhaled, consequently lessened. The addition to the sponge of fresh ether from time to time will sufficiently counteract this refrigeration.

The quantity we have generally found necessary has been about two ounces; yet, as already stated, we are not to be guided by the quantity of ether consumed, but by its effects on the patient. After careful inspection of two hundred cases of both sexes, of all ages, in a great variety of conditions of health and disease, etherized through a sponge without reference to quantity, we have seen no immediate or consequent symptoms, which would lead us to embarrass the patient and the surgeon with a complex apparatus.

The time required is ordinarily from two to five minutes; but this may be prolonged in accordance with the length of the operation, and the difficulty of accomplishing etherization. When this exceeds ten minutes, it is well to raise the sponge frequently, in order to ad-

mit a supply of pure atmospheric air. Dr. J. M. Warren noticed in obstetric cases, that the short panting inspirations natural to the latter stages produced a rapid etherization.

In important operations there is an advantage in preliminary trials, to test the susceptibility of the patient, and instruct him in the manner of the application.

The existence of etherization is usually recognised by the closure of the eyelids, if they had been previously open, by the non-response to questions, and by muscular relaxation. The pulse and respiration should be carefully observed, that, when they fail, the process may be discontinued, and the face of the patient sponged with cold water. Should this not be followed by a revival of the respiration and circulation, according to the advice of Dr. Jackson, oxygen gas may be thrown into the lungs. The stimulus of ammonia applied to the nostrils and throat, with frictions and hot applications over the body and extremities, may also be employed.

Another remedy proposed for the state of insensibility is opium, introduced if possible into the stomach, and if not, into the rectum. In the latter case it should be used with the same quantity of water, and in rather a smaller dose than in the former; as dangerous narcotism, when least expected, sometimes follows injections into the rectum. I have known a gentleman dangerously narcotized by an injection of three drachms of the tincture of opium, used in divided doses in the space of three hours.

Children and infants may be safely etherized with proper precautions: the earliest period in my knowledge

has been within two or three months from birth. In very young infants, the state of the pulse, respiration, and of the senses, should be carefully watched.

The administration to these young subjects, while it should be conducted with great attention, must be made in a decided manner. For when the sponge is applied to the nostril, the child attempts to retreat; but by continuing its application a state of tranquillity soon follows, and a satisfactory etherization is accomplished.

So far as my experience has extended, infants are not more speedily affected than adults, at least not more so in proportion to their tender age; but, as I have always proceeded with great caution in these young patients, I may have been deceived on this point.

For reasons already mentioned, the injection of liquid ether into the rectum must be attended with great uncertainty; and the introduction of vaporized ether into the intestines, as it would operate on an absorbent surface less extended and less active than that of the lungs, could not be employed in ordinary cases with the same advantages as inhalation. There are, however, some conditions, in which it might be proper to throw into the rectum the ethereal vapor, as, for example; first, when this could not be introduced into the lungs; second, in cases when the inhalation had failed; third, when the intestines are the seat of a disease, which the vapor of ether might relieve.

The injection of ethereal vapor into the rectum may be accomplished in the same manner as has been practised for its injection into the Eustachian tube in cases of nervous deafness; namely, by a glass tube having a

perforated bulb at one end, into which the ether is to be poured, and the aperture stopped. The other end of the tube is to be connected with a caoutchouc tube passed into the rectum. By immersion of the bulb in warm water, the vaporised ether will be forced into the intestine.

The subject of medicated ethereal inhalation is one of great importance. I have made some trials of this mode of introducing into the system articles of the *Materia Medica* with much satisfaction, but they are not as yet sufficiently numerous to justify me in recommending the practice.

VII.

Objections have been made to the use of ether in various disorders of the lungs. We have already mentioned instances of pulmonary affection, in which it was used with safety and advantage. When a patient has peculiar irritability of the lungs, it might be wise to avoid its use, unless it were imperiously called for. In common cases of tuberculous affections, whether in a crude or softened state, it is scarcely credible, that any permanent inconvenience could arise.

In children and in infants, although the value of ether is great, in preventing suffering and facilitating indispensable operations, it should always be employed with great care, as previously mentioned, on account of the comparative difficulty of controlling its influence in the tender and excitable age. Ether has been found beneficial in the chronic cough of children, and is likely to be advantageous in whooping-cough, when the inflammatory stage has passed.

In acute pulmonary affections, in individuals predisposed to cerebral excitements and congestions, and in

maniacs generally, the inhalation of ether should not be resorted to till we have had more experience. An instance of its use, however, in a deranged person came within our knowledge.

Dr. Bell, of the McLean Asylum, wished to have an operation for epulis on a lady under his care ; and as he thought there would be no objection, she was etherized. She was not very readily, nor powerfully affected. The tumour was cut from the gum, then the socket from which it sprang was included between three incisions of the bone-cutters, two vertical joined by a third horizontal. Some movements were made during the excision, but she afterwards said there was no suffering. No unusual mental disturbance followed, and in three days she was discharged.

Every day is pregnant with new facts relating to this subject, and we have among others some of great importance bearing on the effect of etherization in cerebral diseases. The supposed dangers of etherization in these affections have been proved by observation to be wholly imaginary in some cases where they had seemed to be greatest.

In the course of the present year, a French physician in Algiers ventured to employ etherization in cerebro-spinal meningitis. An epidemic of this character broke out in the French army of Algiers, from the effects of severe horse-exercise under exposure to the burning meridian sun of Africa. Bleeding, purging, cold applications, and every other remedy suggested by the imagination, were employed to mitigate this disease, which, notwithstanding, often proved fatal in twenty-four hours.

Dr. Besseron, physician of the Military Hospital of Mustapha in Algiers (influenced perhaps by the opinion of the Italian physicians, that the effect of ether is hypo-sthenic or sedative), ventured with many precautions to use etherization in this cerebral epidemic. He never carried it to the period of muscular excitation, employing not more than twenty-five inhalations at one application, and repeating it a number of times in twenty-four hours. After a few inhalations the patients experienced relief from the intense pain in the head and back, and at the close were quite free from pain. Out of twelve patients, eight were essentially relieved: two of them relapsed from adventitious circumstances, but six finally recovered their health—a result extremely remarkable compared with that from other modes of treatment.

Monsieur Besseron does not hesitate to advise the trial of etherization in the meningitis of children.

In delirium tremens it might be expected the practice would not be applicable; but Dr. Stedman has used it in the Houses of Industry and Correction at South Boston with good effect, and we have heard of other practitioners who have employed it advantageously in this affection. There may be other morbid conditions, in which experience will show that etherization is improper.

In old persons the deficiency of reactive power, and consequent danger of extinguishing the vital principle, might excite apprehensions, although experience has not shown any ground for them hitherto.

Cutting operations on the mouth and throat should not, I formerly thought, be performed with ether. But

a greater experience has led to the conclusion, that generally it may be used in these cases with safety and advantage. In excision of the tonsils particularly, the operation is so short, and the bleeding so slight, that there does not seem to be any objection, when the amygdalotome is employed.

VIII.

IN the earlier part of these remarks, the circumstances attending the first use of ether in surgical operations have been sufficiently detailed, and their repetition here will be unnecessary. But there are some facts, relating to the previous history of ether, which we ought not to pass over.

The medical public are by this time abundantly aware, that ethereal inhalation was proposed by Drs. Beddoes, Pearson, and Thornton, for the cure of some diseases of the lungs. Being in London about the period of their publications, I had an opportunity of becoming acquainted with the discussions which then took place on this subject. Its claims were subsequently advocated by Nysten and others.

Sir Humphrey Davy himself successfully employed the inhalation of nitrous oxyde for the relief of pain. In this country, Dr. Horace Wells, of Connecticut, made many trials of this gas in 1844. In the autumn of that year he came to Boston, and, in company with Dr. Morton, visited me at the Medical College, for the pur-

pose of requesting that the medical class should have an opportunity of hearing some remarks on the use of the nitrous oxyde for the prevention of pain. These remarks were actually made, and at a subsequent day a trial of the gas took place. But, as I was very much occupied at the time, these occurrences made so little impression on my mind, that when, in the latter part of 1846, we were assailed in reference to Dr. Morton's first experiments, for a too great facility in adopting novelties, and the facts above mentioned were brought to corroborate the charge, I was for some time not able to understand the grounds of the attack. Dr. Wells, however, in the summer of 1847, mentioned to me circumstances which recalled to my mind his visit; and his statement was afterwards confirmed by that of Dr. Morton. Such are the facts within my knowledge of Dr. Wells's efforts to discover a mode of preventing or alleviating pain in surgical operations. It appears that he did actually prosecute his trials in Connecticut, and elsewhere, to such an extent that, when the matter was investigated by the legislature of the State in the winter of 1847, his labors were thought worthy of honorable notice.

Dr. Marcy, of New York, appears to have had communications with Dr. Wells on the inhalation of ether and of nitrous oxyde; the result of which was, that he advised Dr. Wells to suspend the use of ether, and continue his trials with the nitrous oxyde. Whether these gentlemen had a knowledge of the proposal of Sir Humphrey Davy we are not able to say.

Monsieur Ducos, in Paris, performed some remarka-

ble experiments with ether on animals early in the last year, an account of which is given in the *Paris Medical Gazette*, of March, 1846. In these experiments were exhibited most of the phenomena which have since been witnessed in the human body. The same ingenious physiologist has recently succeeded in producing a state of insensibility to pain in animals by the use of electro-magnetism.

This discovery certainly merits a notice from the American legislature, since it may take rank perhaps of all the great improvements which adorn the present age of surgery. The establishment of union by the first intention, the safe ligature of the great arteries, the substitution of lithotriety for lithotomy, the rejection of pernicious ointments and plasters in the management of wounds, the constitutional treatment of local diseases, and the free external use of cold water, mark the present as a golden period of surgical science.

The introduction of ether enabling us to perform operations, and apply remedies without pain, crowns all these improvements. What remuneration can be too great for such a discovery!

Should the Congress of the United States follow the generous policy of the British Parliament in similar cases, they would naturally institute an investigation into the facts connected with this discovery, and bestow a proper reward on whomsoever was found to merit it; at the same time annulling the exclusive patent.

While we would pay a willing and liberal tribute to the individual who has been made the instrument of this discovery, we should look higher for its author,

and elevate our fervent attributions of praise and thanksgiving to Him who has been pleased, from the rich treasures of His goodness, to confer so wonderful a gift on our generation !

A P P E N D I X .

A.

THE term ether, æther, is derived from the Greek word *αἶθερ*, to consume ; signifying the element of fire situated in the highest region of heaven beyond the air. The date of the discovery of ether is uncertain ; for there are passages in the writings of some of the ancients which may be interpreted to refer to it, but not so explicitly as to render certain a knowledge of it by them. The oldest of these references is by Raymond Lully, of the thirteenth century ; the second by Basil Valentine, of the fifteenth century. In the year 1540, Valerius Cordus, of Nuremberg, describes, under the name of *oleum vitrioli dulce*, an article approximating to very impure sulphuric ether ; the description of which is transcribed by Conrad Gessner, in 1552.

The earliest period at which this fluid is distinctly mentioned by the name of ether, within our knowledge, is in an article by Mr. Godfrey, in the Transactions of

the Royal Society of London for 1730, art. 8, p. 283, in which certain experiments with it are detailed, and its refrigerating and inflammable nature spoken of. Although the writer appears to consider the discovery as originating from a German chemist, Frobenius, an assumed name it is supposed by Macquer; yet he speaks of some experiments with ether in the laboratory of his master, Boyle, at a previous date, and, in corroboration of the accuracy of his statement, refers to the works of Sir Isaac Newton, by whom it is styled *Spiritus vini æthereus*.

This appears to be the first authentic account of ether and its properties. That sulphuric ether was the kind employed, is evident from its mode of preparation, "equal parts, by weight, of vitriolic oil and spirits of wine."

From the year 1730 the attention of chemists was much directed to ether. It was manufactured with difficulty, and in small quantities, until great facilities were introduced by *Hellot*, after whose time it has been abundantly made. At a subsequent period the labor of Baumé, embracing as it does not only a chemical examination of the properties of ether, but also of the various other products resulting from the distillation of alcohol and sulphuric acid, was a great contribution to the chemical science of the time.

From the analysis of Saussure, the composition of pure ether is found to be as follows: Carbon, 64.96; hydrogen, 13.47; oxygen, 21.57.

The ethers are limpid, diaphanous fluids, of a highly volatile nature, and strong penetrating odour. They

are of different kinds, produced by the action of alcohol with different acids; thus we have, besides the sulphuric, the acetic, nitric, muriatic, and chlorine ethers. A variety of the last of these, discovered by Mr. Guthrie, of this country, in consequence of an effort to manufacture the diluted chlorine ether of the Dutch chemists, on the recommendation of Professor Silliman, is esteemed as a mild, diffusible stimulant, constituting so pleasant a drink when diluted with water, as to have been used for purposes of intoxication. The Spirits of Nitrous Ether, Hoffman's Anodyne Liquor, and Clutton's Febrifuge, are well-known preparations.

The effects of nitric ether are more active than those of sulphuric. Both of them have been used internally for many years: their stimulating and very diffusible properties have, however, prevented their extensive employment, excepting in a modified state. They have also been used externally as refrigerants by evaporation. The late Dr. Thatcher, of Plymouth, in Massachusetts, recommended the use of sulphuric ether in this way for the reduction of strangulated hernia.

Mr. Robert Ferguson, an enterprising chemist and apothecary of this city, has furnished me with the following formula for the preparation of sulphuric ether, as pursued at the Norfolk Laboratory, belonging to Messrs. Everett & Blake, and for some years under his charge:

“Into a lead retort, introduce by small portions at a time, through the safety-tube (after the apparatus is luted together), ninety pounds of sulphuric acid, and

ninety pounds of strong alcohol. Raise the heat until it boils gently, and continue it so till sulphurous vapors appear at the orifice of the pipe proceeding from the receiver. The operation will require about one day. A second forty-five pounds of alcohol are added to the mass in the retort, and the distillation continued as before. On the third day the same quantity of alcohol is added, and the distillation continued. When cold, remove the residuum from the retort, and dilute with water, and preserve it for making the sulphate of potassa. Place the distilled liquor in closely stopped demijohns, and add thereto a small quantity of potassa, in order to remove the sulphurous acid with which it is contaminated; agitate occasionally for two or three days, decant, and return it into the retort, which ought previously to be cleaned, as also the receiver and condenser. Let the retort be carefully luted, and apply a moderate heat, not sufficient to produce boiling.

“The sulphuric ether in general use among druggists, contains more or less alcohol and water. It may be obtained pure by adding to it dry sub-carbonate of potassa, as long as it is wetted by the liquor; decanting it, and adding dry muriate of lime. The carbonate in the first instance separates the water, and the alcohol is separated by the muriate of lime. In this manner I have obtained it of the specific gravity of .630 at 60° F. It is not in this state, however, perfectly pure, but contains a quantity of the salts, from which it may be freed by distillation, though not without increasing the specific gravity.”

Ether thus prepared is proper for inhalation, and

we have been in the habit of employing it for this purpose.

The mode of preparation recommended by Dr. Jackson, is as follows. The strongest and purest rectified sulphuric ether, which can usually be obtained from the druggists, is agitated with water, for the purpose of removing all acid. It is then freed from the water it may have taken up, by the chloride of calcium. Its specific gravity is thus rendered about .725.

B.

The opinion expressed in the text as to the comparative period of etherization of the cerebral lobes and the encephalic ganglia, differs from that of the able physiologist, Mons. Longet. Which of the two best explains the phenomena must be decided by a careful observation of facts. In justice to Mons. Longet, it seems proper to present his views on this subject. In his opinion there are a certain class of cases, where, during the operation, the patient evinces the customary signs of pain, and appears to the by-standers to be undergoing the usual amount of suffering; and yet, when the operation is terminated, he declares that he has suffered no pain. It must be recognized that in these cases the etherization has been imperfect, extending only to the cerebral lobes without reaching the cephalic ganglia. In such cases the pain must be allowed to have been *felt*, but *not perceived*—the

cries, groans, etc., were reflex actions from the centre where these sensations are received. The *perception* of these sensations did not take place, because the organ of perception, the cerebral lobes, was under the influence of ether.

The recognition of this fact is of importance in a practical point of view. For if, as we suppose, there be reason to believe that the actual danger resulting from an operation is diminished by its being done with the patient under the complete influence of ether, inasmuch as the nervous centres being dormant, the shock must necessarily be diminished, we must recognize that in this class of cases the shock to the nervous centres may be felt in its full force;—in fine, that the *sensation* of pain may be as injurious as its *perception*, and is equally to be avoided.

Mons. Longet, it appears, maintains the opinion, that in these cases of agitation and crying out the cerebral lobes are first etherized, while the annular protuberance is not; therefore sensitiveness residing, as he thinks, in the latter is not abolished, but the cerebral lobes being in an etherized state take no cognizance of the painful sensations.

Now, in these cases of oblivion of pain, the cerebral lobes, the seat of intellect, being etherized, the intellectual functions should be suspended, according to him, which we know is not the fact in a number of instances. For in such cases, when there are signs of existing sensitiveness, there are also signs of intellectual action; the patient answers questions proposed to him, he also sees and hears.

C.

This case not having terminated at the time the first part of the description was in type, the remainder is inserted here. The stone was about half an inch long, the fourth of an inch thick, and in form of a flattened oval. It was sawn by Dr. J. B. S. Jackson. The exterior layer consisted of a whitish deposit, the sixteenth of an inch in thickness, and composed apparently of triple phosphate. The layers within this were of a brownish color, like that of the phosphate of lime, and were about half a line in thickness. In the midst of these was a harder substance, about a line in diameter, which appeared to be siliceous; its outline could not be exactly distinguished from the surrounding layer of brown deposit. The analysis was committed to Dr. Martin Gay, but was not accomplished in time to enable us to say, whether the constituents were certainly the substances above indicated.

The retrograde passage of the apparent nucleus into the bladder may excite surprise, unless we take into consideration the inverted action of the urethra, by which bodies received into it are so often conveyed from without into this organ, where they serve as the nuclei of stones. The introduction of this nucleus may receive an additional explanation from the fact, that the gravel-stone removed by the mother prevented the passage of urine forced into the urethra by the strong contractions of the bladder, and this not escaping, was

driven back by the contractions of the urethra, carrying along the inner stone which formed the nucleus.

The protracted etherization left behind it no distinguishable symptoms. The boy experienced a moderate invasion of fever, without any abdominal disturbance, or any remarkable local inflammation. The urine flowed through the penis on the second day, but the swelling about the urethra prevented its re-appearance for a week. Since then, it has gradually resumed its natural passage, and now passes wholly by the urethra, though the external wound is not entirely healed. With this exception, the boy is quite well, and on his feet.

The bi-lateral operation employed in this instance, is, in my opinion, the safest and easiest, as I have stated in the American Journal of the Medical Sciences, and which, I am glad to find, has found favor with some able surgeons of the south and west. In the cases where I have employed it, the external wound has the disadvantage of healing more slowly than after the lateral operation.

CHLOROFORM.

In the preceding part of these pages, we mentioned, among the other ethers, a preparation called chloric or chlorine ether. This, in its ordinary state, we used in the early stage of the practice of etherization, without any well marked effect. We have just learnt, that Professor Simpson, of Edinburgh, and Mr. Bell, of London, have employed this liquor in a concentrated state, as a substitute for sulphuric ether, in producing etherization ; and, as stated by the former gentleman, with more agreeable results. But the latter, although the first to use it, after making a number of trials, seems to have abandoned it, on account of the comparative expensiveness.

Professor Simpson says, that it acts in smaller quantity, more speedily, with less irritation of the lungs, more pleasant consequences, and that it has a fragrant smell. He thinks it will prove to be an excellent substitute for sulphuric ether. On employing this article, we have verified the properties ascribed to it by him, so far as to justify the conclusion, that it may

be often used advantageously instead of sulphuric ether. But we are not prepared to support its pretensions to become a substitute for the latter in general practice. We shall, however, proceed to employ it, until a fair trial has been made of its properties, and be governed in its use by the result.

There is one great advantage in this substance, that, being required in small quantity, it may be easily transported; and there is one great objection, that its expensiveness must at present prevent its general use.

We have employed it on a rag, as recommended by Professor Simpson, and also by a sponge, which has proved more satisfactory. But, considering its high cost, it seems better, contrary to the mode employed in administering sulphuric ether, to apply it by an inhaling apparatus, as by this mode it would not come in contact with the skin, and no unnecessary quantity would be used.

CHLORIC ETHER was prepared by Mr. Guthrie, in this country, in the year 1831. His mode, as stated in Silliman's American Journal of the Arts and Sciences, vol. xxi. was this :

"Into a clean copper still, put three pounds of chloride of lime, and two gallons of well-flavored alcohol, of specific gravity .844, and distil. Watch the process, and when the product ceases to come over highly sweet and aromatic, remove, and cork it up closely in glass vessels. The remainder of the spirit should be distilled off for a new operation."

This liquid was subsequently examined by Liebig and Dumas. By the former, Liebig, it has been styled

the *Perchloride of Formyle*, and the following method of preparing it given :

“One part of hydrate of lime is suspended in twenty-four parts of water, and a current of chlorine gas is sent through the mixture until the greater part of the lime is dissolved, and a little milk of lime is added, to make the mixture alkaline. When the solution of chloride of lime has become clear by repose, one-twenty-fourth of its volume of alcohol is added ; and, after being left to itself for twenty-four hours, the liquid is distilled by a gentle heat in a capacious retort. The product has an ethereal odour, and contains *perchloride of formyle*, mixed with alcohol. On shaking it, the perchloride separates as a dense liquid, and may be obtained perfectly pure by digesting it on chloride of calcium, and distilling it again with concentrated sulphuric acid.”

By the latter, Dumas, on account of the relation of its composition to formic acid, it has been denominated *Chloroform*, and the following simple method for procuring it suggested :

“Four pounds of chloride of lime are added to twelve pounds of water, and twelve fluid ounces of rectified spirit. This mixture is distilled as long as a dense liquid, which sinks in the water which it covers over, is produced.”

We are informed by Professor Simpson, that it can also be procured, “by making milk of lime, or an aqueous solution of caustic alkali, act upon chloral ; by distilling alcohol, pyroxylic spirit, or acetone, with

chloride of lime ; by leading a stream of chlorine gas into a solution of caustic potass in spirit of wine," &c.

THE CHLOROFORM prepared by these methods is a dense, oleaginous, transparent liquid, having a specific gravity of 1.480, not inflammable, with a sweetish taste, and a slightly agreeable odour.

2

EFFECTS
OF
CHLOROFORM
AND OF
STRONG CHLORIC ETHER,
AS NARCOTIC AGENTS.

Collins

BY JOHN C. WARREN, M.D.

AUTHOR OF "ETHERIZATION, WITH SURGICAL REMARKS," ETC.



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CHLOROFORM

AND

STRONG CHLORIC ETHER.

A SHORT time since, I received a letter from a distinguished person in Canada, in which my opinion was requested as to the state of the ether practice, and the use of chloroform. This communication led me to see the propriety of publishing some observations and results of a practical nature, which had occasionally presented themselves in the course of my reading and experience. I had, in fact, already promised to do this at the meeting of the "American Medical Association" in Baltimore, last spring, as will be explained hereafter. A natural reluctance to take up a subject, which, however important, has already been so hackneyed, had prevented me from executing this design, until I was repeatedly inquired of as to the actual condition of the ether practice. The very unfavorable influence exerted on this practice by the fatal cases of chloroform seemed also to add to the necessity of a careful consideration of the phenomena with which they were attended. At length I received, among others, the letter already alluded to, from which the following passage is extracted : —

"The use of chloroform had been just announced as your book was going to press; and you reserved your opinion on its merits, till you could speak from experience. In the interim, it does not seem to me, that, in this vicinity, the medical profession are availing themselves generally and with confidence of the aid of the one agent or the other, which I am at a loss to account for; and I am surprised that more has not been said of this wonderful discovery, than appears to have been within the last six months. . . . I have a curiosity to know whether, as you have become more familiar with the use of ether and chloroform, your confidence in it has been confirmed or shaken. Judging from the clear and succinct summing up at the end of your treatise, which all readers can understand, I should expect to hear, that, unless something has occurred to change your views very materially, you would scarcely think of leaving a patient to endure the pain of a severe operation, without giving him, at least, the choice of such relief as you describe. And yet I am not sure that this is now the general practice with you: it certainly is not with us."

In the "Remarks on Etherization," which I published about a year since, it was said, that another year was necessary to give us the means of judging fully and definitively on the merits of the ether practice. Before that publication was fairly out of the press, a new agent was proposed, which was destined to effect a great change in the use of ether.

The introduction of chloroform produced an ex-

citement scarcely less than that of the discovery of the narcotic effect of ether. The beauty of the article, and the rapidity of its influence, gave it an immediate and general currency; for not only was it employed by physicians, but the community took the narcotizing drug into their own hands, and, from the highest to the lowest, indulged themselves in the chloroform excitement. This substance, as proposed and promised in the remarks I had occasion to make on the subject of etherization, was taken up by me, and fairly tried in a great number of instances, and among the first on my own person; so as to give it a thorough trial in every way. In the cases under our direction, it was used with all the precautions possible. The quantity of chloroform was limited; and an inhaling apparatus commonly employed, varying in form according to the ingenuity of the contriver. The apparatus more particularly resorted to was arranged to accomplish inhalation by the nostrils, a sponge or rag being so placed in the box as to permit the mixture of air with the narcotic vapor.

We were soon awakened from our dreams of the delightful influence of the new agent, by the occurrence of unfortunate and painful consequences, which had not followed in this country on the practice of etherization. The profession were led to hesitate, many of them to suspend the use of chloroform, to watch its effects with a jealous eye; and, finally, when the lapse of time produced new cases of fatality in pretty regular succession, some were induced

to relinquish it entirely, and employ the safer and less violent substances, — the sulphuric and chloric ethers.

The loss of a single life, from an application used for the purpose of preventing pain, must make a strong impression on the mind of any conscientious physician or surgeon; and when this occurrence presents itself repeatedly within a short space of time, — affording, as it must do, reason to apprehend the same result in cases otherwise the most favorable, — it becomes the duty of a professional man, either to relinquish the practice, or to find out some way of rendering it safe. Now, it appears that no less than ten well-authenticated fatal cases have presented themselves to the public eye within little more than a year. When we consider that there are other cases not well ascertained, and probably others which have never become public, we are called on to investigate these fatal occurrences with the greatest care, and to discover, if possible, why these patients died, while others have escaped, and whether there are any means of avoiding similar results in the future practice.

Some writers have thought that the fatal effects in these cases did not arise from chloroform, but might be well explained by other causes. In instances, where the fatal result has followed the use of chloroform, with scarcely a longer intervention than death from a wound in the heart follows the stroke of the knife, chloroform has by learned and experienced surgeons been pronounced to be abso-

lutely guiltless of the mortal consequence ; and the death has been attributed to fainting, or syncope ; to apprehension, or fear ; to bleeding at the lungs ; to diseased heart and enlarged liver ; to asphyxia : and, finally, the well-known fact, which we ourselves have formerly cited, that deaths sometimes take place from a violent constitutional impression, has been quoted as the cause. In regard to this last, if such were the true explanation, the crowding of so many cases of rare occurrence into the compass of a few months must form an epoch in the history of this constitutional sympathy.

In order to present the phenomena of the fatal cases produced by the administration of chloroform, we shall bring them together in such way, that they may be readily compared. But, before doing this, some may be mentioned as precursors of the formidable train of results which was to follow.

The cases which first gave me uneasiness as to the effect of chloroform were, among others, the following : —

A lady, Mrs. H. about forty-five years old, in good health, of rather a delicate temperament, had a tooth extracted under the use of ether, in 1847, with favorable effect. In the early part of 1848, having occasion to undergo the same operation again, she applied to the same dentist, a gentleman well practised in the use of ether. Instead of this article, he thought best to employ chloroform, which was given her on a handkerchief, to the amount of about thirty drops. After five or six inspirations, she

had a partial convulsion, was deadly pale and faint. Being laid on the sofa, she recovered in a degree; in ten or fifteen minutes became very sick at the stomach, and continued so all that day. On the day following, the sickness still remained; she had severe headache, loss of appetite, with nervous twitchings of the muscles. At the end of five days she was able to walk out, and came to consult me. Her symptoms at this time were an uneasy sensation in the stomach, stricture across the chest, loss of appetite, headache, and great prostration of strength. The last symptom continued to the month of December; when she came into town again, for the purpose of consulting me once more.

Not long after the occurrence of this case, we received by the "London Medical Gazette" for Dec. 1847, an account of an instance of asphyxia and convulsions, under the influence of chloroform, in Halesworth, England. The writer, Mr. Beales, represents his patient as a young lady, twenty-seven years old, who had labored under neuralgia for three years, and from whom he extracted an upper molar tooth, on the left side. A drachm was at first used; but finding slight effect, from twenty to thirty drops more were poured upon the sponge, which in two or three seconds produced rigidity of the extremities, slight convulsions of the abdominal muscles, extreme dilatation of the pupils; succeeded by the most alarming state of asphyxia, lasting for at least a minute. When re-action came on, she fell apparently into a calm sleep, during which the

attempt was made to extract the tooth. But before the instrument could be removed, the jaws became so firmly fixed as to hold it for two or three minutes; while the arms, legs, and whole body, underwent the most distorted convulsions. At length, the instrument and tooth were removed; the convulsions continuing for five or six minutes longer, though with less violence. She then became half conscious, muttering, "More, more, or I cannot have my tooth out." To this state, which continued half an hour, succeeded a most excruciating pain at the top of the head, lasting twenty minutes; and it was not till the expiration of an hour and a half, that she was enabled to return home.

Within a month from this date, there appeared in the public newspapers an account of a case of convulsions, lasting sixteen hours, at New Bedford, Mass. in an apothecary, who undertook to divert his friends by an exhibition of the effects of chloroform. There also occurred in Baltimore a case of asphyxia from the same cause, continuing an hour and a half, and by which an unfortunate medical student nearly lost his life. In New York, about the same time, a lady, after having a tooth extracted under chloroform, lay fainting for several hours: the recovery of her mental faculties was attended with prostration, paralysis of the tongue, and loss of voice. To these, many similar instances might be added.

But these occurrences were of trifling importance, compared with others which followed. A number

of individuals, in the full vigor of youth and health, were struck dead under the very hands of the surgeon raised for their relief; and, in one or two instances, the proposed operation was unknowingly performed on a lifeless body.

The causes of death from chloroform have naturally attracted the careful attention of physiologists and physicians. They have been anxious to discover, why this article has produced many more dangerous effects than ether, and what organ was attacked with so great violence as to interrupt suddenly its functions, and consecutively the other functions of animal and organic life.

Very careful and minute investigations and discussions, intended to answer these questions, have been undertaken by learned physiologists and pathologists in various countries. My intention is not to follow in the search so ably pursued elsewhere by others, but to endeavor to throw some light on these critical inquiries, by bringing together, in a comparative view, the most remarkable phenomena these fatal cases have presented, in order to ascertain whether they agree in any one or more circumstances which may offer a clue to the peculiar effects of chloroform, and the means of obviating them. To attain this object, it was necessary to present simply the most remarkable phenomena in each case, and then to compare them by constructing a Table.

CASE I.

NAME. — Hannah Greener.

DATE. — Jan. 25, 1848.

DISEASE. — Onychia.

PREVIOUS USE. — Sulphuric ether, two months previous.

TIME OF INHALATION. — About half a minute.

QUANTITY CONSUMED. — About a drachm.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Two minutes.

SYMPTOMS. — In half a minute, no change of breathing or alteration of pulse; arm rigid; insensibility; after semilunar incision, a twitch; sudden blanching of lips; spluttering at the mouth; not the slightest attempt at a rally; death.

MORBID APPEARANCES:

Brain. — External and internal congestion more than usual; rather more than usual quantity of serum in ventricles.

Heart. — Healthy; dark fluid in both cavities, less in left.

Lungs. — Not collapsed; one or two slight adhesions; external surface of both highly congested; mottled with deep purple, bluish, or scarlet patches; crepitant; small emphysematous bubbles along outer and interior border of both, more on upper lobe of left; bloody froth in tissue and in bronchi; epiglottis reddened; also mucous

membrane of larynx reddened and mottled ; dark mucus in the sinuses.*

Liver, kidneys, and spleen, congested ; digestive organs healthy.

Some veins more distinct than usual.

Rigidity as usual.

CAUSE OF DEATH ASSIGNED BY JURY. — Congestion of the lungs produced by chloroform.

CASE II.

NAME. — Arthur Walker.

DATE. — Feb. 5, 1848.

DISEASE. — None.

PREVIOUS USE. — Frequent.

TIME OF INHALATION. — Unknown.

QUANTITY CONSUMED. — About half an ounce.

POSTURE. — Leaning forwards.

LAPSE OF TIME TILL DEATH. — Uncertain.

SYMPTOMS. — Not known.

MORBID APPEARANCES :

Brain. — Veins on the upper surface full, not turgid ; pia mater injected ; puncta vasculosa larger than usual ; velum interpositum and choroid plexus much loaded with dark-colored blood.

Lungs. — Turgid ; loaded with dark-colored blood, particularly at the upper margin of the lowest lobe of right lung ; lower lobe of left and

* *Query.* — Sacculi laryngis ?

smaller portion of upper lobe of right engorged, of apoplectic character, emphysematous.

Heart. — Old adhesions of pericardium; right side distended with thin and dark fluid blood; walls of right ventricle unusually thin; cavity enlarged.

Blood. — General mass darker than usual.

CAUSE OF DEATH ASSIGNED BY JURY. — Asphyxia, consequent on the inhalation of chloroform.

C A S E · III.

NAME. — Mrs. Martha G. Simmons.

DATE. — Feb. 23, 1848.

DISEASE. — Extraction of the stumps of teeth.

PREVIOUS USE. — None.

TIME OF INHALATION. — About a minute.

QUANTITY CONSUMED. — Uncertain.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Estimated by two witnesses at about two minutes; by the dentists, from five to ten.

SYMPTOMS. — Face pale during inhalation; groans during extraction, but no other sign of consciousness. In two minutes from beginning of inhalation, head turned to one side; arm slightly rigid; body drawn backwards; pulse feeble, and instantly stopped, so with respiration; face, previously pale, now livid; lower jaw dropped; tongue pro-

jected at one corner of the mouth; arms perfectly relaxed.

MORBID APPEARANCES :

Brain. — Integuments contained but little blood; more than usual in vessels of dura mater; superficial vessels moderately distended; from sinuses of dura mater, two or three ounces of fluid blood mixed with bubbles of air; aspect, character, and color, normal.

Heart. — Flaccid, cavities empty, inner surface of all deeply stained; six drachms of bloody serum in pericardium; aorta and pulmonary artery empty; cava empty in chest, containing very little in abdomen; lining membrane of all blood-vessels deeply stained.

Lungs. — Considerable congestion, crepitant, no extravasation; congestion of lining membrane of bronchi; deeply stained; great injection of pleura; six drachms bloody serum in right, two ounces in left.

Liver. — Pale. Kidneys engorged.

Blood. — Everywhere fluid as water; no coagulum in any vessel; examined by the microscope some alteration in the form of globules; some irregular; generally more distended and globular than normal, also somewhat fragmentary; number somewhat diminished; color, dark venous.

NOTE. — Professor Mussey, who was called upon to superintend the examination of the dead body of Mrs. Simmons, informs me that this patient inhaled through an apparatus "in such manner as to prevent air passing

through her nose, so that probably little or no air was received into her lungs, except through the valve of the inhaler. It is impossible to determine how much chloroform was consumed. A piece of sponge, occupying about two-thirds of the space in the globe of the inhaler, was saturated with chloroform, besides not far from half an ounce of the free liquid remaining in the vessel. This was after the experiment made by Mrs. Simmons."

CASE IV.

NAME. — Patrick Coyle.

DATE. — March, 1848.

DISEASE. — Fistula.

PREVIOUS USE. — Once.

TIME OF INHALATION. — About one minute.

QUANTITY CONSUMED. — About thirty drops.

POSTURE. — Upon the side.

LAPSE OF TIME TILL DEATH. — About one minute.

SYMPTOMS. — Showed signs of pain by putting hand to the part; in a moment, his pulse, which was full and natural, sunk; death.

MORBID APPEARANCES:

Brain. — This, with the membranes, natural and healthy.

Heart. — Enlarged, pale, soft; two or three ounces of serum in pericardium; blood-vessels with dark fluid blood.

Lungs. — Studded with tubercles; abscess in in each; lower parts congested; pleura extensively adherent.

Stomach. — Mucous membrane softened, its veins turgid.

CAUSE OF DEATH ASSIGNED. — Disease of the lungs.

CASE V.

NAME. — Mlle. Stock.

DATE. — June, 1848.

DISEASE. — Opening an abscess in hip.

PREVIOUS USE. — None.

TIME OF INHALATION. — Less than one minute.

QUANTITY CONSUMED. — From fifteen to twenty drops.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Very brief.

SYMPTOMS. — After several inspirations, tried to withdraw handkerchief; crying, — “I choke;” face suddenly pale; countenance changed; breathing embarrassed; foam at the mouth.

MORBID APPEARANCES:

Brain. — Superior longitudinal sinus empty; veins on convex surface not engorged, but the column of blood broken at intervals with bubbles of gas, also air in veins at base of the skull, also escaped with the blood from ophthalmic veins, cavernous sinuses, and inferior cerebral veins; serum in lateral ventricles moderate; substance firm.

Heart. — Serum in pleura and pericardium;

heart excessively flaccid; right and left cavities empty; not the smallest clot; frothy blood in the orifice of ascending cava; a little blood mixed with air from pulmonary veins; internal membrane of heart red, especially of right cavities; tissue pale.

Lungs. — Especially left, voluminous, visibly engorged in lower lobes; on incision, a very black fluid blood; remarkable crepitation; pulmonary vesicles dilated with air, probably from the artificial respiration; neither interlobular nor sub-pleural emphysema; tracheal mucous membrane bright red; no froth in bronchi.

Liver. — Very large; air-bubbles with much black and fluid blood escape on incision. *Intestines* distended with foetid gas. *Spleen* softened, gorged with blood, bubbles of air escape on pressure.

Blood. — As black as ink; air bubbles up from a remarkably black and very fluid blood from internal saphæna and left crural; blood-vessels near the wound found to be perfectly entire.

CAUSE OF DEATH ASSIGNED. — Syncope, caused by sudden suspension of the cerebral functions under chloroform.

C A S E VI.

NAME. — Daniel Schlyg.

DATE. — JUNE 25, 1848.

DISEASE. — Disarticulation of thigh.

PREVIOUS USE. — None.

TIME OF INHALATION. — Four or five minutes.

QUANTITY CONSUMED. — Not stated.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — Three quarters of an hour.

SYMPTOMS. — Face very pale, lips discolored, pupils dilated, eyeballs rolled upwards; respiration infrequent and sighing; pulse no longer perceptible; limbs perfectly relaxed.

MORBID APPEARANCES. — No autopsy was made.

CAUSE OF DEATH ASSIGNED BY THE SURGEON,
M. ROBERT. — Syncope.

C A S E VII.

NAME. — Walter S. Badger, gentleman.

DATE. — June 30, 1848.

DISEASE. — Operation on teeth.

PREVIOUS USE. — None.

TIME OF INHALATION. — One minute.

QUANTITY CONSUMED. — A drachm and a half.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — One minute.

SYMPTOMS. — Face livid, pupils dilated, temperature of the body lower than natural.

MORBID APPEARANCES :

Brain. — Nothing abnormal; slight congestion of corpora striata and optic thalami; membranes congested.

Chest. — Lungs and heart pushed up as far as third and fourth ribs; lungs healthy; crepitant throughout; some adhesions; on right, little congestion.

Heart. — Pale; flaccid; not hypertrophied or dilated; some adipose spots on surface; walls of left ventricle thinner than usual; fatty degeneration of tissue, especially at apex; clots of dark grumous blood in both ventricles; inner surface of aorta rough; mitral valves unequal at their edges; tissue hard, grating.

Abdomen. — Omentum fatty; stomach not distended; liver very large, reaching up to third and fourth ribs; pale, brownish, dirty-white; weight, eight pounds.

CAUSE OF DEATH ASSIGNED BY JURY. — Obstruction to the heart's action from an enlarged liver, and the influence of chloroform thereupon.

CASE VIII.

NAME. — A young woman of Hyderabad.

DATE. — July 11, 1848.

DISEASE. — Amputation of middle joint of middle finger of left hand.

PREVIOUS USE. — None.

TIME OF INHALATION. — Very brief.

QUANTITY CONSUMED. — A drachm.

POSTURE. — Sitting.

LAPSE OF TIME TILL DEATH. — Instantaneous.

SYMPTOMS. — Slight cough, with a few brief convulsive movements.

MORBID APPEARANCES. — No autopsy was made.

CASE IX.

NAME. — John Griffith.

DATE. — Jan. 19, 1849.

DISEASE. — Chancres and hemorrhoids.

PREVIOUS USE. — Chloroform on Dec. 26, 1848.

TIME OF INHALATION. — None given.

QUANTITY CONSUMED. — About three drachms.

POSTURE. — Lying on one side.

LAPSE OF TIME TILL DEATH. — About ten minutes.

SYMPTOMS. — Face and neck of a livid, leaden hue ; the eyes turned upwards ; the pulse imperceptible

at the wrist ; respiration laborious ; the whole body relaxed ; after two or three gasps, he ceased to breathe.

MORBID APPEARANCES :

Brain. — Healthy ; no other appearances than in persons dying when in full health.

Heart. — Large ; its ventricles and auricles empty ; its condition flabby ; the substance of the left ventricle rather softer than natural.

Lungs. — A good deal congested ; and discharged, when cut, a large quantity of bloody serum.

About half an ounce of a watery fluid was found in the pericardium.

C A S E X.

NAME. — Abby Pennock.

DATE. — March 6, 1849.

DISEASE. — Toothache.

PREVIOUS USE. — Frequent.

TIME OF INHALATION. — Unknown.

QUANTITY CONSUMED. — Three drachms in two applications.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — Probably instantaneous.

SYMPTOMS. — Unknown.

MORBID APPEARANCES :

Externally, the body livid over the whole left

side ; face and neck swelled ; pupils slightly dilated ; thyroid gland enlarged.

Brain. — Free from congestion, or any other morbid aspect.

Heart. — Flaccid ; empty of blood ; only a very small coagulum in its cavity.

Lungs. — Not much collapsed ; both congested ; the left throughout, the right of a bright vermilion color ; entrance to the larynx inflamed, and covered with small ulcerations.

Abdomen. — Semi-digested food in stomach ; lacteals full of chyle ; intestines in a remarkably decomposing condition. *Liver* not altered. *Spleen* rather large, and contained great numbers of distinct whitish bodies smaller than the head of a small pin, not tubercles. *Left kidney* congested. *Uterus* with catamenia.

By the above Tables, we learn the

TIME OF INHALATION to have been —	Cases.
Less than a minute in	3
About a minute	3
Four or five minutes	1
Uncertain	3

QUANTITY.

Half a drachm and under	2
A drachm, but less than two	3
Between two and three	1
Uncertain	4

POSTURE.

Sitting	5
Leaning forwards	1
Recumbent	4

LAPSE TILL DEATH.

Within one minute	4
Within two minutes	2
In ten minutes	1
In three quarters of an hour	1
Uncertain	2

MORBID APPEARANCES.

Not given	2
<i>Brain</i> —	
Congestion moderate	4
„ none	4

Heart —

	<i>Cases.</i>
Healthy	1
Enlarged and soft	2
Disordered	1
Excessively flaccid	2
Flaccid	1
Flaccid, compressed by liver	1
Mostly free of blood in all.	

Lungs —

Congestion great	4
„ considerable	3
„ little	1

Blood — In each instance black and fluid.

Dark and fluid	1
Darker than usual	2
Dark, venous, fluid as water	1
Black as ink	1
Not stated	3

AIR IN THE VEINS mentioned in 2

MODE OF INHALATION.

From an apparatus	2
„ a sponge	1
„ a towel	3
„ a handkerchief	4

It has been stated, that the greater part of the victims of chloroform were females. An examination of the cases recorded shows, that the numbers are exactly equal, five males and five females. The questionable cases hereafter cited are two males and one female.

In a Review in the "London Medical Gazette" for Sept. 1848, page 424, a quotation is made from "Remarks on the Employment of Anæsthetic Agents in Midwifery," by G. T. Gream, in which he says : — "For they should know that fatal consequences have ensued from the use of chloroform during parturition."

We have thought it right to mention this allusion ; but, as there is uncertainty about it, it should not be considered, in the present state of our information, as a well-authenticated statement of death from chloroform. It seems a little remarkable, that in these cases, and also in some others mentioned above, in which it could scarcely be doubted that chloroform was the cause of death, no examination of the dead body was made, or at least none reported.

M. Malgaigne, in the "Proceedings of the French Academy of Medicine" for October 31, 1848 (*vide* "Gaz. Med. de Paris" Nov. 18), reports a case as follows : —

"A man, wounded in June, had the neck of the humerus broken by a ball, which was lost in the flesh. Two abscesses formed, and were opened without discovery of the ball. Finally, gangrene appeared in the wound, and the patient was sinking under secondary hemorrhage. Having at length decided to attempt the scapulo-humeral disarticulation, with scarcely any hope of saving him, but rather to prevent him from dying of hemorrhage,

the patient was put to sleep by chloroform. He aroused after the operation; but the search for the ball, which had been split in two against the scapula, and buried in the walls of the thorax, requiring another incision, chloroform was again applied to the nostrils; and the incision, commenced upon the living, was finished upon the dead body. His condition was so desperate, that I could not for an instant attribute his death to chloroform; and there is no surgeon who, in similar circumstances, has not had the grief to see patients die under his hands."

M. Roux, at the sitting of the Academy of Medicine for Jan. 16, 1849 ("Gaz. Med. de Paris," Jan. 20), related the following interesting case, in which he attributed the death to syncope:—

"Some months since, I was called on to operate upon a female, fifty years of age, with a cancer of the breast. She was much debilitated. Besides the tumor of the breast, the glands of the axilla were also much diseased, and their extirpation judged necessary. I did not hesitate to put her under the influence of chloroform: during the sleep, which was sound, I removed the tumor. The first operation was hardly ended, when the patient awoke. It then remained for me to extirpate the glands in the axilla: this I begged her to permit me to do without resorting to chloroform. She consented. The operation was long and laborious. The dressing was applied; then, according to my usual custom, a bandage rolled around the body. To apply this

bandage, she was made to sit up; syncope at once took place; all efforts to re-animate were vain; the patient was dead."

In the "Paris Medical Gazette" of Jan. 20, 1849, a case is related, in which chloroform produced very alarming appearances. The patient was a lady, who had passed the middle period of life, affected with a tumor in the groin, of very large size. Chloroform, being previously administered, produced some rigidity of the muscles; but the patient, ultimately coming under its full influence, went to sleep, and the operation was performed without pain. After the operation was over, she awoke; and, the dressing requiring a painful application of sutures, chloroform was again administered, and the dressing was completed under its influence. Immediately after, alarming symptoms presented themselves. The patient was taken with a chattering of the teeth, extreme paleness of the face, almost complete discoloration of the lips, dilatation of the pupils, rapid depression of the pulse, which became imperceptible for some time, convulsive movements of the face, and contractions of the flexor muscles of the hands, rigidity of all the extremities, stertor, a little rattling, slight delirium, muttering. This condition lasted for about seven or eight minutes. Fresh air was thrown upon the face, and she was stimulated by the vapor of ammonia; by which applications she was gradually brought to herself, though not without great anxiety on the part of her medical attendants.

The following case is one of so recent occurrence, that I am induced to give it at length : —

“ John Griffith, an Irishman, aged thirty-one years, a seaman in the navy, who was admitted into the New York Hospital early in December, on his return from Mexico, suffering with diarrhoea, chancres, and hemorrhoids, died from the administration of chloroform on Saturday, while undergoing an operation. A coroner’s jury so declared, adding that the use of it was proper and justifiable in the case. The affidavit of Dr. Buck tells the whole story :

“ Gurdon Buck, jun. attending surgeon to the New York Hospital, being sworn, says, ‘ That, on or about the 26th December, I advised that chloroform should be administered to the deceased, for the purpose of examining the condition of the rectum ; the parts being in a state of such excessive irritability as scarcely to admit of a separation of the nates. The patient recovered from the effects of the chloroform, and remained in all respects in the same condition as before its use. On the 19th of January, the deceased being in a sound condition, except the local ailments spoken of, and he having never complained of either his head or his chest, and not having suffered from the first administration of chloroform, I directed it to be administered to him for the purpose of performing an operation upon the rectum, and the operation of circumcision, to remove a phymosis caused by the chancres. The patient soon became excited by the chloroform, as

is usually the case, but not beyond a degree which I have often observed. Shortly after, he became more tranquil. The deceased was placed upon his side, and the operation performed, which consisted in the removal of two external tumors, and the tying of one internal tumor.

'At this moment my attention was arrested by my assistant calling for a wet cloth. On examining the patient, I found his face and neck of a livid, leaden hue or color, the eyes turned upward, the pulse imperceptible at the wrist, and the whole body relaxed; after two or three gasps, he ceased to breathe. Every means was promptly used to restore the deceased, but without effect. The chloroform was obtained at Kent's, 91, John-street, and not exceeding three drachms was administered from a napkin: a portion of chloroform from the same phial had been administered the day before to a patient, without any unfavorable effects. About ten minutes elapsed from the commencement of its administration before death took place. On making a post-mortem examination twenty-four hours after death, I found the face less livid than before death: on examining the head, the brain and its membranes presented no other appearances than are seen in persons dying when in full health; the lungs were a good deal congested, and discharged, when cut, a large quantity of bloody serum; the heart was large, its ventricles and auricles were empty, its condition flabby, the substance of the left ventricle rather softer than natural; about half an ounce of a watery

fluid was found in the pericardium; the viscera of the abdomen were healthy.

‘GURDON BUCK, M.D.

‘Surgeon to New York Hospital.’

“ Drs. Kearney Rodgers, Buel, and Bathgate testified to the proper use of the chloroform. Dr. R. has seen it used a hundred times without any bad effects.”

Dr. Parker, Professor of Surgery in New York, to whom I had written on the subject, gave me a statement confirmatory of the deposition of Dr. Buck.

Another fatal case of chloroform has this moment occurred, March 6, in Boston. The following were the circumstances: — A young woman, Abby Pen-nock, 17 years old, finely constituted, came a few weeks previous to live as domestic in a highly respectable family. Being troubled with toothache, and occasionally with pain in the side, she applied for medical advice. On a visit to her physician, she asked him for chloroform, and he gave her a few drops. She then took the phial, poured the liquid freely on her handkerchief, and inhaled it until fairly under its influence.

On the evening of March 6, she went out, and, having had the toothache, used chloroform. After her return home, she ate a good supper, and soon went to bed. In half an hour, a young woman who lodged in the same chamber went to her room, and, on entering it, spoke to her, but, receiving no answer, presumed she was asleep, said no more, and went

to bed herself. She noticed that the window of the chamber had been opened, as she has since thought, to take off the smell of the chloroform; and, having no objection herself to its being so, she allowed it to remain open, although the temperature was below freezing.

The next morning, when she arose, finding that Abby was not stirring, she did not attempt to rouse her, but dressed and went about her business. As the latter did not appear, her room was visited about half-past 6, A.M. and she was discovered in bed lifeless and cold. She lay on her left side with the knees drawn up, and all the limbs in a rigid state. Dr. Jeffries was immediately sent for, and very soon arrived. On viewing the appearance of the body, he perceived the left hand clenched over the mouth, and the right arm crossing the left. An examination of the left hand detected a handkerchief crowded in its hollow, which being removed, the foetid odor of stale chloroform was perceived. Suspicion being excited, search was made around the room and in the drawers for a bottle containing the suspected liquid; but none was discovered. Afterwards, when the body was moved, a bottle of chloroform fell out of the bed. It was a two-ounce phial, and three fluid drachms of it had disappeared.

Dr. Jeffries proposed an examination of the body; and, this being consented to, he called on Dr. J. B. S. Jackson, who performed it.

EXTERNAL APPEARANCE. — The body was livid

over the whole of the left side on which she had lain. The face and neck were swelled, so that the string of her night-cap produced a distinct indentation. The pupils of the eyes were slightly dilated. The thyroid gland was much enlarged.

Thorax. — The lungs were not much collapsed; both of them were congested, but the congestion in the right was bright-colored, while that on the left was purple. As the lungs were much collapsed, the congestion could not be excessive. The *heart* was flaccid, and empty of blood. Nothing was found in its cavities, but a very small coagulum.

Head. — The brain was entirely free from congestion. There was a little water in the ventricles, but no other remarkable appearance.

Abdomen. — The stomach contained a considerable quantity of food in a semi-digested state, and the lacteals were full of chyle. No morbid change in the mucous coat. There was no appearance of poisonous substance. The *intestines* were in a decomposing condition, quite remarkable, considering that she had been alive and on her feet the evening before. The *liver* was not altered. The *spleen* rather large, and contained great numbers of distinct whitish bodies, smaller than the head of a small pin, not tubercles. The *left kidney* was congested. The *uterus* exhibited a catamenial appearance.

REMARKS.—To what has been stated above may be added, that there was reason to believe the chloroform was purchased on the evening it was taken; that it

had been used during that evening, at least once before the fatal application; and that the three drachms which had disappeared must therefore be divided between the two applications; that there is no reason to believe, that any other article of a poisonous nature was employed; that there can be no reasonable doubt of the patient's having died the evening before, and died instantaneously; that she did not die from suffocation, but of the effects of chloroform. She must have died instantaneously; because, if the dying state had been prolonged, the hands would have been removed from the mouth in all probability by spasmodic movements of the muscles; and she probably did not die of asphyxia, as the lungs were not so much congested as they generally are in cases of suffocation. And, on the whole, the phenomena in this case agree with those presented in the other fatal cases of chloroform.

In considering what organ might be principally affected by the deleterious agent in producing the fatal symptoms, my first impression was, that the lungs were primarily disordered, and that death arose from non-oxygenation of the blood. The suspended or struggling respiration, purple color of the skin, irregularity of the pulse, muscular spasms, &c. led to this opinion. If it were the fact, we

should find a great engorgement of the lungs, of the right side of the heart, and probably also of the brain. Now as to the lungs, we find them engorged more or less in every case, but excessively engorged in four. And, on the whole, they do not present the degree of engorgement which accompanies asphyxia. The same may be said of the heart. As to the brain, the accumulation in its vascular system has been found to be for the most part very slight. The blood, in every case where it is mentioned at all, was found in a fluid state. There does not, then, appear to be any morbid change uniformly exhibited in either of these organs, which authorizes us to consider the disturbance of such organ to be the immediate cause of death.

The facts which we have collected and compared, while they do not support the doctrine that death occurs from a visible alteration in any of these great organs, seem to leave us only the nervous system, independent of vascular action or congestion, as the seat of the sudden change produced by the rapid passage of the narcotic principle to the great nervous centres. This is, indeed, to be considered a mere hypothesis at present; but, as the object of these remarks is altogether of a practical nature, I shall not undertake to examine the subject physiologically, in order to prove the truth of this hypothesis. The fluidity of the blood, in every case where the blood is mentioned at all, goes to show, that its vitality had been suddenly destroyed by the action of a deleterious principle. The flaccid state of the

heart, which appears in every case examined, affords another fact in favor of the same opinion.

In a large part of the fatal cases, one fact at least is conspicuous; and that is the suddenness with which the fatal phenomena occurred. In four cases death took place within a minute; in two, in two minutes; and in my patient, Mrs. H. five inspirations, requiring a few seconds only, produced symptoms which lasted a long time. When we compare these sudden effects of chloroform with those from its continued use in many cases of prolonged operations, it seems quite clear, that the fatal issue is not a consequence of the quantity inhaled, nor yet of the time, but rather of the instantaneous violence of the impression.

An important objection to chloroform is the facility with which it may be abused. The highly concentrated state of the toxic principle, the convenience with which the substance may be transported, the absence of the penetrating and diffusible property of ether, favor its use in an undiscoverable manner. Hence it has happened, that many persons of both sexes, and of all ages, have resorted to it for the purpose of obtaining the pleasure of a temporary delirium. The number of individuals whom I have known to use it in this way is so considerable as to lead me to believe, that those who employ it in secrecy must be very great. Persons, therefore, who recommend chloroform, for the purpose of preventing pain or procuring a transient pleasure, must take into view the probability that

the patient will resort to it afterwards without medical advice; that the habit of taking it may be thus formed, and origin given to the most pernicious consequences.*

An English gentleman, Mr. Carruthers, was in the habit of using chloroform for relief from the asthma. He was an expert angler, and sometimes sat till a late hour arranging his hooks, and making artificial flies. In this position, he was found one morning by his servant, apparently pursuing the occupation of the evening previous; but he was soon ascertained to be dead, while upon the table lay the handkerchief and chloroform. We have not heard of a post-mortem examination in this case.

A physician in New York, who had attained some distinction, and who suffered from mental trouble, resorted to the use of chloroform so frequently as ultimately to produce a delirium; during which he committed some extraordinary acts, and finally destroyed himself.

It is true, that an objection may be raised against ether on the same grounds. This has been replied to in the "Remarks on Etherization" by the fact, that the volatility of ether is so great as to reveal its use. The quantity required is also such as to make it much more difficult to conceal the employment.

* This remark has been verified, at the moment these sheets were correcting, by the case of a young woman in this city, who took chloroform for the relief of toothache, and fell a victim to its effects. — *Vide Case X.*

A practical conclusion, then, from these cases, which seems to me unquestionable, is, that chloroform, containing the narcotic principle in a highly concentrated state, like many other powerful agents in *Materia Medica*, although it may be employed in this state in some instances, yet in common practice should be used, if at all, in a diluted form. If this fact is admitted, we are naturally led to ask whether we shall use it thus diluted, return to sulphuric ether, or whether there are any other narcotic, or, as they have been called, anæsthetic agents, which may advantageously be substituted.

Various such substitutes have been proposed; among them are the nitrous oxide gas, as employed by Dr. Wells, and different articles experimented on by a number of physiologists. None of these seem well calculated to be substitutes for chloroform and sulphuric ether.

On hearing of the first fatal cases of chloroform, the thought occurred to me of giving a more thorough trial to the chloric ether of commerce. This, as is well known, is the product of the distillation of alcohol and chloride of lime. I had tried it formerly, as stated in my first publication, and now tried it a second time with great care, but without any narcotic effects.

After the preceding experiment, I tried the first portion of the product of the distillation without purification, and without mixture with the residuum, or any additional preparation. The first person to whom this was administered was a patient of Dr.

J. Mason Warren, suspected to have a stone in the bladder, who had been so very irritable, that it was impossible to sound him satisfactorily. He inhaled freely from a sponge; in about four minutes, went to sleep; the sound was at once introduced without any trouble, and a stone detected. Under the influence of the same preparation, the lithotritic operation was performed; and, after two or three applications, the stone was removed. In four or five other cases of stone, — one of them an oxalate of lime case, in which the calculus was very refractory, — the patients were conducted safely and successfully through the lithotritic treatment, under the influence of chloric ether, by the same operator.

Among the subsequent cases in which this ether has been employed, I will mention only a single class, with a couple of interesting illustrations. The admirable effect of sulphuric ether, in enabling us to break down the adhesions in joints stiffened by inflammation from fractures and other causes, has been stated in the "Remarks on Etherization." Chloric ether has been used a great number of times for the same purpose, and with results equally favorable: —

About the beginning of February, 1849, a young lady, who had fallen on the ice three weeks before, and broken the olecranon process of the ulna, was brought to me, with a stiff elbow, by her parents. Various efforts were made to move the fore on the upper arm; but the patient expressed so much pain,

it seemed necessary to desist. As she had not been allowed to move the arm at all, I recommended to her to go home and bend the arm, or have it bent, every day, and thus to increase the motion as much as possible; and, if she found that nothing was gained, to come to me again in five days. At the end of the time indicated, she was brought, and I found that nothing had been accomplished in moving the joint. She was then etherized by Dr. Mason Warren to the point of physical insensibility, and I attempted to restore the natural motions of the arm by force. It was, however, impossible for me to accomplish it in this case. She was therefore etherized with the chloric ether two minutes longer, fell asleep; and then, renewing my efforts, the adhesions and muscular contractions gave way with an audible crack. Two other etherizations were required to effect the restoration of the perfect movements of the limb.

A patient of mine, who had apparently undergone inflammation of the spinal marrow, with phenomena very curious, but which cannot properly be mentioned here, on recovering was found to have a false ankylosis in the right hip, a true ankylosis with dislocation in the left. Under the use of chloric ether, the ankylosis in the right hip was broken with a very loud crack. The left could not be at all moved. It was therefore resolved, in order to give him a fair chance, to employ pulleys for breaking down the ankylosis, and reducing the dislocation. He was bled nearly a pint; then, having used chloric

ether many times before with excellent effect, it was employed; but the state of susceptibility was so altered, that both this, sulphuric ether and chloroform were tried; the administration requiring nearly three quarters of an hour before he was narcotized. The pulleys were applied for fifteen minutes; during which one of the cords was snapped, and replaced. Efforts to move the limb were then made, but without accomplishing any motion of the os femoris on the os innominatum. The patient was then roused from his state of etherization, and recovered almost immediately. On the day following, he experienced some pain in the right hip, which I had moved during etherization; but the force applied to the left had not produced any pain or soreness. This happy immunity is to be attributed, I think, to the precursory bleeding.

As the dislocated left limb was inverted to such a degree, that the left knee constantly impinged upon the back and inner part of the right, thus interfering in an embarrassing and painful way with its motions, and in fact disqualifying the patient from any active occupation, it was determined to saw through the upper part of the thigh-bone, in order to admit of rotation of the limb outwards. This was happily accomplished on March 17. Chloric ether, used at this time, narcotized the patient in five minutes; and he continued, with occasional applications of the sponge, in a state of total insensibility for ten minutes longer, during which time the operation lasted.

The first of these trials of chloric ether was in March, 1848; between that time and the month of May (when I mentioned the subject to the American Medical Association), the strong chloric ether was used in fifty cases with perfect success, so far as regards the narcotic influence, and without any unpleasant occurrence at the time or afterwards. The experience of that term has been confirmed by the observations of ten additional months, so that I now employ it almost exclusively.

It may be objected to the strong chloric ether, *first*, that it irritates the skin, as chloroform does; — *second*, that it causes nausea; — *third*, that it is, in fact, chloroform diluted with alcohol; — *fourth*, that, when chloric ether is administered by a wet sponge, the alcohol combines with the water in the sponge, and leaves chloroform to be inhaled.

In answer to the *first* objection, we should say that it is not necessary to use this ether in such way as to irritate the skin; also, that the skin is easily protected by a cloth, and by various contrivances, particularly by rubbing the face with an unctuous substance previously. *Second*, That the subsequent sickness, so far from being an objection, is an advantage; for, in patients who have experienced it, the lungs are relieved from congestion, and therefore recover from narcotism more rapidly. *Third*, The fact that it is chloroform diluted with alcohol does not form any objection to its use, since the chloroform is sufficiently diluted to render its inhalation safe. *Fourth*, The supposed decomposition of the

strong chloric ether, in consequence of the combination of its alcohol with the water in the moist sponge, may be obviated, by those who believe in such a combination, by administering the chloric ether on a handkerchief, towel, or other cloth not moistened. It is, however, probable that any portion of alcohol, which combines with the water of the moist sponge, being reduced to the state of rum, the exhalations would enter the lungs with the chloroform, and help to dilute its narcotic property.

It may be asked, whether chloric ether has any advantage over sulphuric. In my opinion, it has. It irritates the lungs less; its inhalation is more agreeable; and it never has produced headache in the operator and by-standers, as is the case in regard to many individuals from sulphuric ether. As to the narcotic power of the two articles, there seems to be but little difference.

The distinguished Mr. Lawrence is said to have used chloric ether in the summer of 1847, but whether that of commerce or the concentrated I am ignorant. The idea of using this agent was suggested to me by seeing the process of preparing the chloric ether of commerce and the chloroform by Mr. W. B. Little. Alcohol and chloride of lime being distilled together, the product of the distillation is the chloric ether of commerce; but a small quantity of the first product of distillation is much stronger than the aggregate. Taking therefore this

first product, I made trial of it, as before mentioned, and found it produced a satisfactory narcotic effect. Mr. Little has since improved the process, and prepares his chloric ether in the following manner, as he has kindly informed me by letter : —

“Take the first run (that is, what passes first in distillation) when distilling chloroform, and re-distil from water containing an excess of lime, which gives a perfectly pure ‘chloric ether,’ free from chlorine or any other impurity. We furnished Dr. Warren with different samples, until he was satisfied with the strength, and since then have uniformly made it of the same quality. Our ‘concentrated chloric ether’ contains $33\frac{1}{2}$ per cent pure chloroform, the remainder being nearly absolute alcohol (containing but about 4 or 5 per cent of water).”*

After this article had been employed in a considerable number of cases, the subject was brought forward (not by me), as already stated, at the meeting of the American Medical Association, at Baltimore, in 1848. Having used it myself, I felt bound to give to the Association some account of its introduction, and of my reasons for using it. The President of the Association, Dr. A. H. Stevens, called on me to furnish a copy of the remarks I made, for

* I have been informed, that a chloric ether made in Philadelphia does not, when water is added, undergo the separation of chloroform, while that made here does. I have tried the experiment myself, and it has been tried by two of my friends, one a physician, the other a chemist; and we have all found that chloroform does separate in both, on the admixture of water. The fact is, however, of no practical importance, since the chloric ether prepared as above answers the purpose.

publication in their proceedings. This I did not wish to do at that time, because a longer experience seemed necessary; and because the dangers of chloroform were not so fully established as to exclude the suspicion, that they might have arisen from a careless use of the article.

Since that time, May, 1848, the fatal cases have more than doubled. The apprehensions, grounded on these occurrences, have led me to use, in preference to chloroform, the ethers, — either sulphuric or chloric, — and five times out of six the chloric, employing the former only for the purpose of comparison with the latter. I have never seen or heard of any accident from the use of chloric ether, which gave me reason for discontinuing it; and I think I can confidently recommend it to the profession, as more safe than chloroform, and more agreeable than sulphuric ether. Should any one, preferring chloroform to the ethers, feel disposed to employ this article in a diluted state, he might very properly add a certain portion of alcohol. I have used two parts of the purest alcohol with one part of chloroform; but have not sufficient experience of its effects to enable me to say, that these are the best proportions.

There are cases in which chloroform will have an advantage. We occasionally find instances of a want of susceptibility to the narcotic action. In such, after trying in vain the use of ether, the more powerful impressions of chloroform have been resorted to with good effect. I cannot say, however,

that this has occurred in my practice more than two or three times out of a great number of cases.

Chloroform, used externally, does not produce an anodyne effect, when employed on a surface of moderate extent, as for example a leg. It causes a slight cutaneous irritation, which sometimes relieves pain, and sometimes aggravates it. Taken internally, a fluid drachm of chloroform, diluted in two ounces of water, seems to have an anodyne influence. This dose may be repeated at intervals of an hour or less, two or three times.

Strong chloric ether, employed in very small doses, has much the same effect as spirits of nitrous and sulphuric ether. So far as regards its anodyne property, it does not answer for internal use, through the medium of the stomach, as well as chloroform.

To the questions contained in the letter at the beginning of this article, and to those which have been addressed to me from other quarters, I now reply in a few words by stating: — 1st, That my confidence in the beneficial effects of ether, in surgical operations, is undiminished; but if I were compelled to substitute chloroform, I should do so with much anxiety. 2d, Etherization is not, I think, employed so extensively as it was during the period of enthusiasm following the first inhalations of ether. The occurrence of fatal cases of chloroform has done much to cause a diminution of the use of ether, and the latter article has not been free from the charge

of pernicious consequences. No fatal case from its use has transpired, however, in this country, nor in Great Britain, so far as we know. One well-authenticated instance only has occurred in France.* The details of this case I am not able to give, further than to say, that the patient was a male, resident in Auxerre, about forty years of age, who underwent an operation for cancer of the breast, and died in ten minutes. 3d, Chloroform or ether is used in this part of the country in all capital operations, and I believe pretty generally in such operations in other parts. In parturition, also, the former is extensively employed here; but a considerable number of practitioners use it rarely, and only in cases of extreme suffering. The relief from pain is uniformly said to be great; but whether the patient does as well on the whole after this narcotism is a doubtful point with me, confiding as I do in the power of nature to render this process generally perfect without the aid of art. In surgical operations, there is every

* Dr. Snow, of London, one of the best writers on ether and chloroform, and a strong advocate for the latter, gives the following opinion on the supposed bad cases of ether in the "London Medical Gazette" for November, 1848, p. 841, note:—"I am aware that ether was thought by some to have caused death in two or three instances, in which the patient did not recover from the operation, but died two or three days afterwards; and, in one of these instances, a coroner's jury returned a verdict to that effect. But I believe the only instance on record in which the inhalation of ether was fatal was one that occurred in France (see "Gazette Medicale, 4 Mars," and "Med. Gaz." p. 432, last vol.); and, in that case, the inhalation was continued without intermission for ten minutes, although alarming symptoms were present nearly all the time; and it is probable that the result was owing as much to some defect in the inhaler, which limited the supply of air, as to the effect of ether."

possible evidence, that the chance of success is not diminished by etherization.

An attempt has been made to parallelize the unfavorable cases of ether with those of chloroform, with a view to determine the proper application of each of these to different cases. No such parallelism can be legitimately established. The fatal instances of chloroform, to whatever cause they may be imputed, are sudden, and are unequivocal sequels of chloroformization. Those of ether, on the contrary, are, with a single exception, lingering cases, subsequent indeed to the application of ether, but not immediately connected with it in time. The former mostly occurred within a few minutes of the administration, and none are considered as unquestionable poisonings by chloroform which have been prolonged an hour or more; while those alleged to be from ether, — varying in number from five to ten, according to the varying judgment of different persons, — have been prolonged to a number of days, during which, time enough elapsed to admit the intervention of various causes. There is therefore no good ground for the effort to specialize cases to which the application of chloroform and ether is relatively proper; ether is generally safe; chloroform cannot be said to be safe in any case. It has destroyed the feeble and the strong, the sick and the well, the young and the middle-aged; and no practitioner can be reasonably assured in his own mind, that it will not prove fatal the next time he employs it.

Means of preventing and remedying the bad Effects incident to the Chloroform Practice.

First, To use chloric or sulphuric ether, for the purpose of producing narcotism in surgical operations, in preference to any other agent. *Second*, Not to use narcotism for trifling operations. *Third*, Where the operation is not very severe and prolonged, to produce only that degree of narcotic influence, which destroys the susceptibility to pain, without abolishing the intellectual functions. *Fourth*, To be careful that the patient does not get an exclusive inhalation of the narcotic vapor, but obtains with it a sufficient quantity of atmospheric air to carry on the oxygenation of the blood; and, when he is unpleasantly affected by the first impulse of this vapor, not to press it too harshly upon him. *Fifth*, When a powerful application is required, as in cases of the reduction of hip-dislocation, the patient should always be bled before etherization. It is very desirable, that a powerful narcotism should never be produced, without previous abstraction of blood, except in cases of great debility. *Sixth*, The respiration and pulse should be carefully watched, during the whole operation, by one in whom the operator can confide. *Seventh*, When the pulse intermits, and respiration is suspended, inhalation should not be continued. *Eighth*, The position of the body does not appear to exert a particularly unfavorable influence; of the fatal cases,

five occurred in the sitting posture, four in the horizontal, and one in a state of flexion forwards on a table. *Ninth*, Whenever etherization is to be accomplished, there should be a sufficient number of assistants present, to guard the patient if he should become violent. *Tenth*, To protect the face, a small towel is folded in a funnel-like shape, in the apex of which is placed a sponge, double the size of an egg, charged with an ounce of chloric ether; or the liquid may be poured directly on the interior of the cloth. *Eleventh*, Chloroform or ether should not be administered upon a full stomach, nor in cases of epilepsy, of active organic disease of the heart, of acute affection of the lungs, or in a hemorrhagic tendency of these organs. *Twelfth*, The fatal effects of chloroform, in almost every instance, have been produced by small quantities.

Some very judicious physicians and surgeons are of opinion, that the dose of chloroform should be exactly measured; and that, if this were rigidly and uniformly attended to, any calamitous consequence would be avoided. Should the use of chloroform be continued, this might be desirable; and the most exact apparatus for accomplishing this object is a small box, intended to receive the chloroform and the sponge or cloth containing it. To this box are appended two tubes, five or six inches in length, and fitted to the nostrils, through which alone inhalation should take place. In this way, the utmost precision may be attained.

The ethers, however, have the great advantage of

not requiring this extreme exactness of administration. A large sponge, imbued *ad libitum* with ether, we have seen employed in a great number of instances, and know that it has been employed by distinguished surgeons in whose judgment we have very great confidence. This profuse administration is not what we have recommended. A more sparing and precise exhibition seems better adapted to the power of the substance and the importance of the object, for the attainment of which it is given.

On the means of restoring the vital actions, when suspended by Chloroform or Ether.

First, When the pulse and respiration are suspended, the face should be dashed with cold water from a sponge. *Second*, A free passage of air to be directed to the patient's nostrils and mouth. *Third*, Inflation through one of the nostrils by an inflating tube, or, if this is not at hand, by the bellows; the opposite nostril and the mouth being closed, and the larynx pressed backwards to prevent the air from going into the stomach. *Fourth*, Forced movements of the chest, in imitation of respiration. *Fifth*, Friction of the chest, abdomen, and extremities. *Sixth*, Heat applied to the same parts. *Seventh*, The nostrils to be stimulated with the vapor of aqua ammoniæ. *Eighth*, The fauces irritated with a brush or quill-feather dipped in aqua ammoniæ. *Ninth*, The introduction of stimulating liquids into

the stomach by a gum-elastic tube. *Tenth*, The use of galvanism, if an apparatus can be immediately obtained. *Eleventh*, Inflation with oxygen gas of the nostrils and lungs. *Twelfth*, Inflation of the lungs through an aperture between the thyroid and cricoid cartilages. *Thirteenth*, A limited application of caustic ammonia to the region of the heart. *Fourteenth*, Convulsions to be treated by bleeding, vapor of ammonia, cold to the head: for the sudden production of the latter, evaporation of sulphuric ether answers well.

CONCLUSION.

I hope it will not be thought presumptuous in me to propose the substitution of the ethers for an article which, although so deleterious to some individuals, has been and is still extensively used with safety on others. My apology must be found in the reflection, that, for more than a year before the introduction of chloroform, the ether-practice was carried on without any fatal result; that several fatal cases from chloroform occurred in a much shorter space of time than that above mentioned; and that a number of practitioners will feel absolutely compelled to abandon the employment of these anæsthetic agents, if chloroform be looked to as the principal. Moreover, the suggestion of a judicious friend will have its weight in forming this apology.

“Nor would it,” he writes, “alter my opinion of the wisdom of strongly urging the objections at this time, should longer experience show, that the disasters in the use of chloroform, during the year past, arose from peculiar coincidences; and that it is, in reality, as safe as the sulphuric ether. In so grave a matter, we should be willing to be proved over-cautious, rather than the contrary.”

POSTSCRIPT.

While the preceding pages were in process of printing, new instances of the fatal consequences of the inhalation of chloroform presented themselves. Some of these cases are detailed with a minuteness which leaves us little to desire; others, on the contrary, are reported in so meagre a style as to allow us to remain in great obscurity. On the whole, however, though three of them are scarcely more than mentioned, yet, as we really believe that they are of the same character, and have equal importance with the others, we cannot pass over them in silence.

We shall present here five additional instances. The first, which we quote from the "Gaz. Med. de Paris" of January, 1849, is that of a patient who underwent the extraction of a tumor, not remarkable for its size, or for the danger of its situation. The patient never seemed to recover perfectly from the effects of the chloroform.

The second case occurred in the Hotel Dieu of Lyons, a medical establishment highly distinguished for its scientific character, and for the reputation of

the illustrious savans who actually discharge its duties. The details of this case are wanting; but they are spoken of by the editor of the "Gaz. Med. de Paris" as having been already published, and as of unquestionable authenticity.

The third case is said to have occurred at the Bicêtre, in September, 1848; but the details are not at hand.

The fourth case we take from the "London Lancet." The description was no doubt published before the details could be obtained: these we shall probably see hereafter.

The fifth case occurred at the Hotel Dieu, at Lyons, and is described with much care and minuteness.

I. — *Case of Death attributed to Chloroform, by M. Vanini.*

Copied into "Paris Med. Gazette," Feb. 17, 1849, from the "Gazzetta Medica Lombarda."

On Jan. 25, 1848, at the Hospital at Côme, was made the first trial of chloroform. Petronille F. a peasant woman of Alzate, aged thirty-six, having the aspect of fine health and flourishing nutrition, was put under the influence of chloroform, in order to undergo the removal of a sarcomatous tumor. The operation, very trifling in itself, was promptly performed, unattended with accident; nor was it indeed capable, under the circumstances, of compromising the life of a woman so healthy. She was

put to sleep by pouring about a drachm of chloroform on a sponge, which was applied to the nostrils. The effect, although tardy, was complete; but the consecutive phenomena were such as led the author to think that chloroform developed an action much more powerful, if not more rapid, than ether. In effect, the pain in the head, the dulness and stupidity of the mind, somnolency, giddiness, slowness and embarrassment of her pronunciation; in fine, all the symptoms which announce the state of cerebral congestion were prolonged for more than eight hours after the operation. Nor can we reasonably affirm, that, at the end of this time, all the phenomena were entirely dissipated; for the next day the pains in the head continued, with a feeling of fulness and of dulness, accompanied with a burning fever.

The thorax and abdomen, being slowly and attentively examined, manifested no symptoms of pain, or signs of lesion, with the exception of a slight cough, which the patient said she had already had habitually. The wound resulting from the operation had a pale and greasy appearance.

The chief surgeon of the Hospital, suspecting a latent inflammation of some of the viscera, prescribed bleeding, which diminished the fever and the pain in the head.

At the visit on the morning of the 27th, the patient was tranquil. Four hours after mid-day, she was seized with irregular and prolonged chills. At nine in the evening, she died suddenly.

AUTOPSY. — The membranes of the brain were in a state of abnormal turgescence. The cerebral hemispheres exhibited their ordinary consistence. All the vessels of the interior of the encephalon were gorged with blood. The cutting of the cerebral pulp exhibited numerous bloody points. The marrow was softer in the lumbar region than elsewhere. Its coverings were slightly injected.

The lungs were filled with blood, and softened. There was some bloody serum in the pleura. The heart was normal as to size, but flaccid, and without blood in its cavities.

No morbid appearance was exhibited in the abdomen, if we except a bloody suffusion of the spleen, which was softened, like a bladder full of a blackish, fluid pulp.

The kidneys were softened, and natural as to form and size.

REMARKS. — This case, attributed to chloroform by M. Vanini, does not come in exactly the same class with those we have considered as normal cases of poisoning by chloroform, because the death did not take place under the immediate influence of this agent. That the patient did actually die from the effects of chloroform, there seems little reason to doubt, since she never revived fully from its first effect, and did not experience any other symptom sufficient to explain the cause of death. The morbid appearances correspond nearly with those of other chloroform cases: — the same dark color of the blood, congestion of the lungs, flaccidity of the heart,

but a greater degree of congestion of the brain. The last-named circumstance is attributable to the comparative slowness of death in this case. The lungs, so far as we can judge from the statement, were more congested than usual; and the gradual accumulation of blood, constituting this congestion, would also be a natural consequence of the slowness of the morbid changes.

II. — At the Hotel Dieu of Lyons, Charles Desnoyers, aged twenty-two; of scrofulous habit, affected with white swelling of the left wrist. Chloroformization with an apparatus during five minutes. Transcurrent cauterization of the joint. Death at the commencement of the operation.

III. — An instance reported by J. Guérin as having taken place at the Bicêtre, in Sept. 1848. A man suffering from a lesion of the thigh. Chloroformization; coxo-femoral disarticulation. Death before the end of the operation.

IV. — A death from chloroform is reported in the "London Lancet," Jan. 6, 1849, page 25, as follows: —

"The 'Glasgow Herald' states, that recently a young gentleman returned from Australia, to visit his relatives in the neighborhood of Govan (a town about four miles from Glasgow). Before leaving the colony, he met with a slight accident in the foot, which, being perhaps neglected during the pas-

sage home, caused the great toe-nail to grow into the flesh. To remove the pain and inconvenience, the gentleman resolved to submit to an operation, which a respectable surgeon in Govan was employed to perform on Tuesday last. Preparatory to doing so, the surgeon resolved to make use of chloroform; but the patient, after inhaling the gas, almost instantly expired."

V. — *Case of Death from Chloroform at the Hotel Dieu of Lyons.*

Reported by M. le Doct. Barrier. "Paris Gaz. Med." No. 7, Feb. 17, 1849, page 115.

To the Editor of the "Union Medicale."

Mr. Editor, — Whilst the discussion of chloroform is still pending at the National Academy of Medicine, I believe it my duty to publish, without delay, a case of chloroform-inhalation followed by death, which I have just had the pain of witnessing at the Hotel Dieu of Lyons. Hitherto an avowed partisan of chloroform, I do not now know whether I shall decide to continue or abandon the use of it.

J. Verrier, aged seventeen, of lymphatic temperament and good constitution, entered the Hotel Dieu of Lyons, Jan. 24, 1849. He bears on his limbs the scars of scrofulous ulcers, which he attributes to the labors of his trade, that of a miner. He comes to the Hospital for a disease of the middle finger of the right hand, consisting of a complete necrosis

of the first phalanx, with suppuration, fistulæ, and fungosities of the two joints, of which this bone makes a part. The affection not being curable without an operation, the 31st of January is appointed for it. The intention is to amputate the finger, and to cut out as much as is necessary of the metacarpal bone.

The day having arrived, after being assured that the patient otherwise enjoys good health, and has taken no aliment, he is placed upon a bed, and put under the influence of chloroform, which he had desired, and which inspired him with no apprehensions. The phial containing the anæsthetic agent is the same that has been used, but a moment previous, to put a young girl to sleep, in whose case all had passed off regularly. As usual, a compress of very thin texture is drawn over the face, leaving free passage for the air; and chloroform is dropped, with many intervals, on the part corresponding to the nasal aperture. Two assistants, very familiar with the administration of chloroform, are entrusted with this, and, at the same time, with the exploration of the pulse at the wrist. The operator overlooked and directed the labor of his assistants. After four or five minutes, the patient still feels and speaks. Hardly another minute has elapsed when the patient pronounces some words, and manifests slight agitation. In all, about six or eight grammes (from one to two drachms) of chloroform are absorbed; or, rather, this is the quantity dropped on the compress, and evaporation has necessarily exhausted the

greater part of it. The pulse continues with perfect regularity, as it regards the rhythm and force of its motions. All at once, the patient hastily raises his body, and moves his limbs, which escape from the assistants; but they promptly seize them again, and replace the sick man in his position. This movement has lasted certainly not more than a quarter of a minute, yet one of the assistants immediately announces that the pulse at the wrist has ceased to beat. The handkerchief is taken away. The face has surprisingly altered. The action of the heart has altogether ceased. There is no longer any pulse or any sound in the region of the heart. Respiration still continues; but it becomes irregular, feeble, slow, and at last stops entirely in the space of about half a minute.

At the first signal given, energetic measures are directed against the accidents, the gravity of which is immediately perceived. A little ammonia upon a cloth is immediately applied to the nasal aperture. A large quantity is poured upon the thorax and abdomen, which are forcibly rubbed. The same substance is employed to irritate, if possible, the most sensitive parts of the integuments, as the lips and the genital mucous membrane. Mustard is applied. His head is inclined over the edge of the bed. Finally, an attempt was made to restore respiration by pressing alternately upon the abdomen and the chest. After two or three minutes, respiration returns, and even has a certain fulness; but the pulse is not again aroused. The frictions are

persisted in. Respiration is again slackened, and ceases a second time. The hopes that had been raised vanished. Air is blown into the mouth, and even into the larynx, a probe being introduced through the aperture of the glottis; because, while blowing into the mouth, it was perceived that the air passed into the stomach. The cauterizing irons having been put into the fire at the commencement of the accidents, the surgeon cauterized powerfully the precordial, epigastric, and prelaryngeal regions. The pulse does not revive. Still every conceivable effort to restore the patient to life is continued for over half an hour. These efforts are useless.

The *AUTOPSY* could not be made till seventy-two hours after death. The weather being sufficiently cold, the body does not exhibit any marks of decomposition. There is still a decided rigidity of the limbs. The features show no particular alteration. A careful examination is made of all the organs.

The *stomach* contains about forty-five grammes of a thick fluid; the color of lees of wine, but not at all resembling any alimentary liquid. It is distended with gasses, and also the rest of the digestive canal. With this exception, it is healthy. The *liver* and *spleen* are a little congested.

The *heart*. — Size normal, flaccid, empty of air and blood. The walls of the ventricles are moistened by a thin froth, very red, giving one the idea of a little blood that has been beaten by the fleshy pillars of the heart. The *venæ cavæ* and *vena porta* are distended with black fluid blood, very copious.

Over the Eustachian valve is found a fibrinous clot of blood, of little consistency, weighing four or five grammes, being all that is met with in the cavities of the heart and great vessels. Moreover, these cavities are opened with sufficient attention to render it certain that there was no accumulation, in any observable quantity, of any aeriform fluid.

The *lungs* are very much contracted on the opening of the thorax. They exhibit a very decided dark slate-colored appearance. A section of the lungs exhibits the same tint. With this exception, the tissue is healthy. The larynx and trachea show no lesion. The brain is unaltered. The sinuses and the dura mater contain a considerable quantity of black uncoagulated blood.

REMARKS. — The phenomena in this case accord with those of the other fatal cases. The lungs were dark-colored, and their contraction showed that there was no great accumulation of blood, as there is in most cases of asphyxia. The heart was, as in every case we have noted, empty and very flaccid, as if it had been suddenly deprived of its *vis insita*, or organic power, by a deleterious agent. No air was detected in its cavities or in the blood-vessels. The brain was unchanged, exhibiting of course nothing which would lead us to believe, that death had been produced by an organic lesion of this viscus. The blood, so far as it is mentioned, — and this has only been done incidentally, — was found in a fluid and dark-colored state, such as would result from the action

of a poison. The morbid appearances in other organs are not of a character to lead us to believe, that they had any material influence in causing death.

We are therefore led to the conclusion, that the fatal result is not to be attributed to simple asphyxia, to accumulation in the heart or in the brain; but that it may be ascribed to an undiscoverable toxic action received by the lungs, and thence conveyed to the nervous centres.

The administration of chloroform seems to have been judiciously conducted, admitting, in its full extent, the fact that the cloth or compress, by which the chloroform was applied, was, as stated, of a thin and open texture. No case can more clearly show the dangers of chloroform.

Summary of Case I., p. 54.

NAME. — Petronille F. aged thirty-six years.

DATE. — Jan. 25, 1848.

DISEASE. — Sarcomatous tumor.

PREVIOUS USE. — None.

TIME OF INHALATION. — Between five and six minutes.

MODE. — From a sponge.

QUANTITY CONSUMED. — About a drachm.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — About fifty hours.

SYMPTOMS. — Pain in head; dulness and stupidity of mind; somnolency; giddiness; slowness and embarrassment of pronunciation; all symptoms of cerebral congestion, lasting more than eight hours; not then entirely disappearing, but some fever present; death in about fifty hours, sudden.

MORBID APPEARANCES:

Brain. — Membranes turgid; cerebral hemispheres of ordinary consistence; all internal vessels greatly gorged; puncta vasculosa many; spinal marrow softer than natural in lumbar region; its coverings slightly injected.

Heart. — Normal in size; flaccid; no blood in cavities.

Lungs. — Filled with blood and softened; bloody serum in pleura.

Spleen. — Softened, like a bladder full of a blackish fluid pulp.

Kidneys. — Softened ; natural in form and size.

Summary of Case V., p. 58.

NAME. — J. Verrier, aged seventeen years.

DATE. — Jan. 31, 1849.

DISEASE. — Necrosis of first phalanx of right hand, with fistulæ, fungosities, &c. of the two joints.

PREVIOUS USE. — None.

TIME OF INHALATION. — Between five and six minutes.

MODE. — From a thin compress drawn over the face, and chloroform dropped at nasal apertures, with many intervals.

QUANTITY CONSUMED. — Between one and two drachms.

POSTURE. — Recumbent.

LAPSE OF TIME TILL DEATH. — Between five and six minutes.

SYMPTOMS. — In four minutes, feels and speaks ; in five, slight agitation, and speaks ; pulse perfectly regular ; at once, he hastily raises his body, and moves his limbs ; pulse at wrist ceases ; heart ceased its action ; no pulse, or sound in region of heart ; respiration irregular, feeble, slow, then stops in about a minute.

MORBID APPEARANCES :

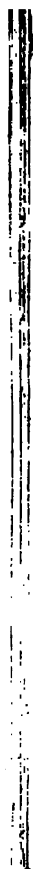
Brain. — Unaltered ; sinuses and dura mater contain a quantity of black uncoagulated blood.

Heart. — Size normal ; flaccid ; empty of air and blood ; walls of ventricles moistened by thin froth, very red ; vena cava and porta distended with black fluid blood, very copious ; small fibrinous clot over Eustachian valve ; no other in cavities of heart or great vessels.

Lungs. — Much contracted on opening of thorax ; dark slate-colored appearance ; same tint on section ; otherwise healthy.

Stomach. — About a couple of ounces of thick fluid, like lees of wine ; not like alimentary liquid ; distended with gasses, like rest of the canal ; otherwise healthy.

Liver and spleen a little congested.



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Receive my sincere acknowledgments, and believe me to be, with the highest esteem and respect, your obedient servant,

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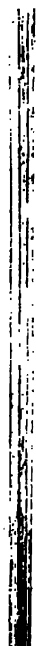
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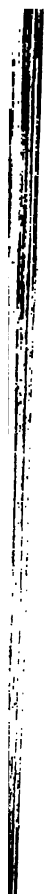
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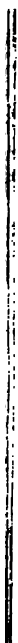
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With the highest regard, your obliged friend,

D. A. WHITE.







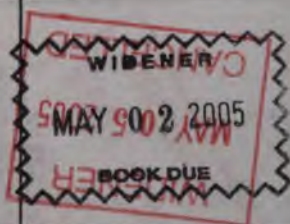


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